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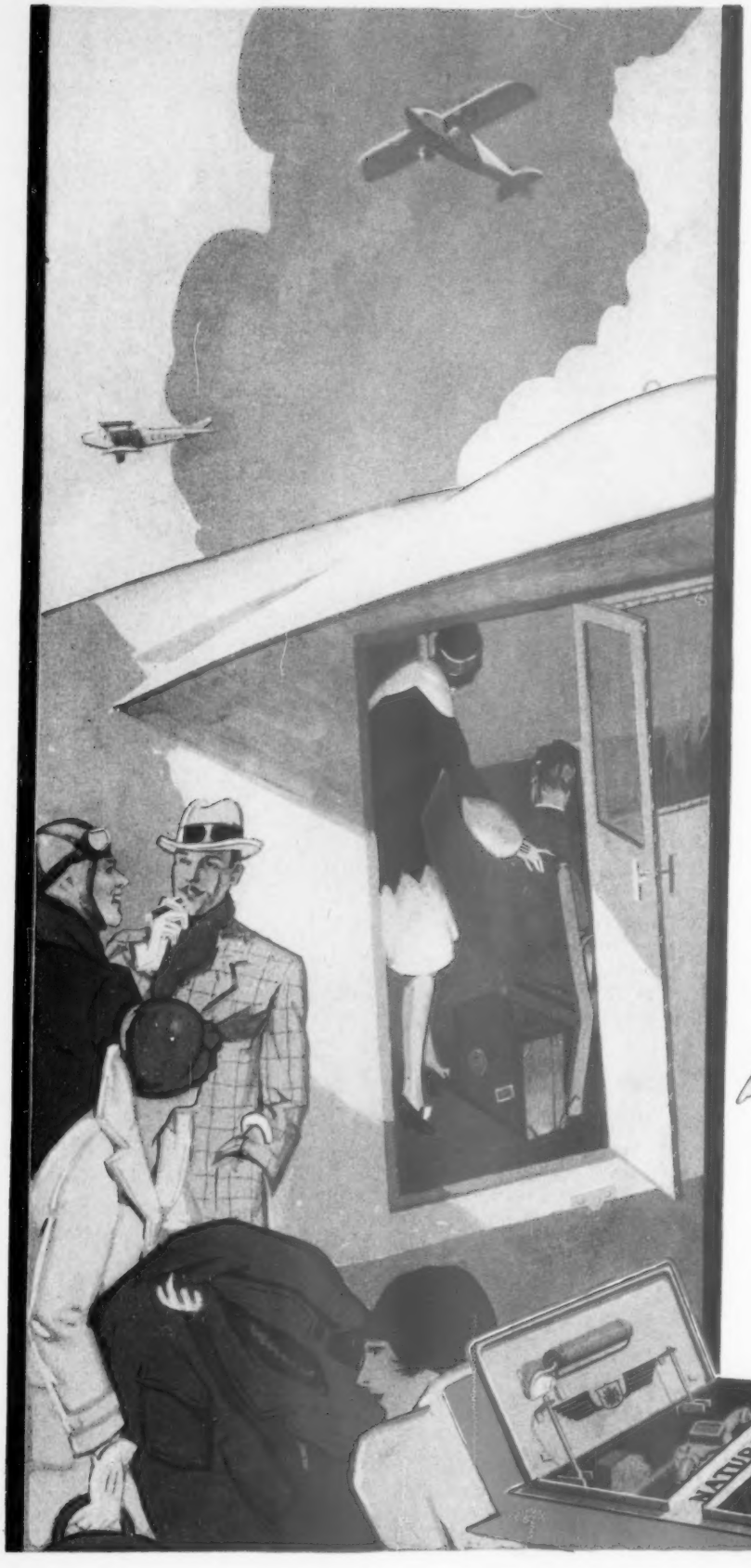

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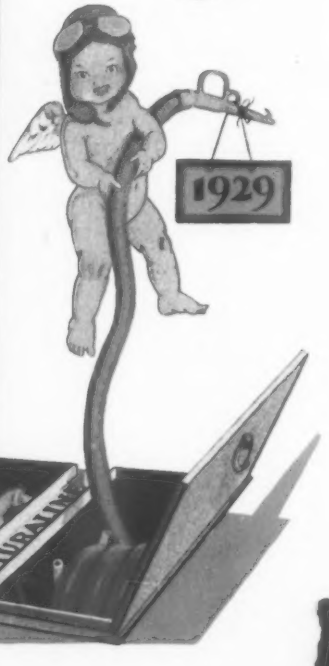

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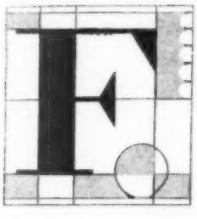

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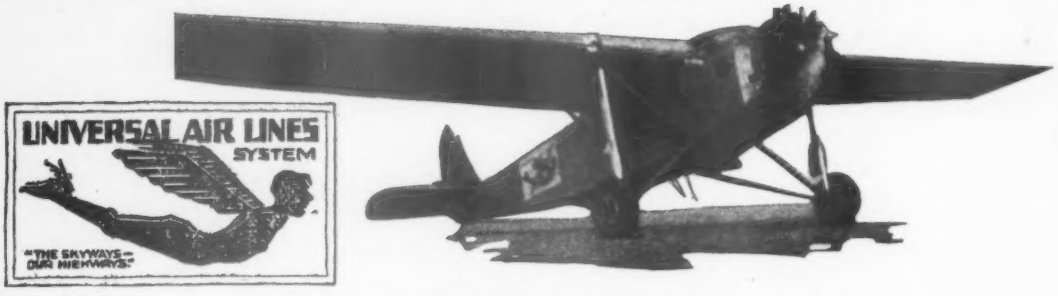

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12:11	" .....St. Paul..... "	12:20
12:50	" .....Rochester..... "	11:40
3:30	Ar. .....Chicago..... Lv.	9:00

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EASTBOUND READ DOWN	AIRPORT	WESTBOUND READ UP
4:00	Lv.....Chicago (c.s.t)....Ar.	8:35
7:45	Ar...Cleveland (e.s.t)..Lv.	6:50

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NOTE: This Division is operated with Tri-motored airplanes.

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Partial List Table of Contents

CHAPTER ONE
Airfoils, Lift and Drag
Airfoils; flat plate and curved plate—Cambered Airfoils—Airfoils for different purposes; high lift, general purpose, high speed—Drag—Head Resistance—Streamlining—Fairing—Wind Pressure at various velocities.

CHAPTER TWO
Control
Control by Flaps—Ailerons and their Functions—Flippers and their Function—Rudder—Co-ordination of Controls.

CHAPTER THREE
Inherent Stability
Stability Defined—Relation of Momentum to Stability—Longitudinal Stability—Why a Plane Flies "Hands Off"—Directional Stability—Propeller Torque—Dihedral—Losses due to Dihedral.

CHAPTER FOUR
Interesting Points in Design
Aspect Ratio—Stagger—Monoplane or Biplane—Tail Skid—Airplane Engines—Water Cooling vs. Air Cooling—Cost of Airplane Engines—The Propeller.

CHAPTER FIVE
Construction of Airplanes
Wings—Fuselage—Monocoque Fuselage—Landing Gear—The Empennage.

CHAPTER SIX
Practical Flying—The Slotted Wing
Stalls—Result of a Stall—More About Flying Speed—Air Speed in Turns—The Slotted Wing.

CHAPTER SEVEN
The Weather and Aviation
Wind—Gales—Squalls and Gusts—Rain, Snow, Sleet and Hail—Fog—Lightning—Bumps—"Air Pockets."

CHAPTER EIGHT
Airports—Airways—Safety
Airports and Airways—Safety in Aviation—Aviation Accidents—Structural Failure—Error of Pilot—Accidents due to Weather—Crashes in the Air—Parachutes—Fires in the Air.

CHAPTER NINE
Pilot Licenses—The First Lesson
How to Become a Pilot—Inspection—Taxiing—Taking-off—Climbing—Flying Level—Turns and Banks—Landing.

CONCLUSION—Terminology.

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Popular Aviation

Published Monthly

Vol. 4, No. 1 | A magazine for everyone interested in aviation progress and development | January, 1929

Leighton W. Rogers

Leighton W. Rogers, of the Department of Commerce, was Executive Officer of the International Civil Aeronautics Conference, called in Washington, December 12, 13, and 14 by President Coolidge. The immediate purpose of the Conference was to commemorate fittingly the twenty-fifth anniversary of the first flight by man in a device heavier than the air it displaced. To this end, guests from every part of the world were invited to join in a common consideration of the problems shared by all, with better understanding and broader sympathy as the very natural result. The Conference was a conspicuous success and POPULAR AVIATION wishes to take this opportunity to express the satisfaction felt everywhere among those concerned for the best interests of aviation.

CONTENTS

Announcement 9
First Aeronautical Exposition 11
Why Not Retail Airplanes? 18
Denmark in the Air 22
Cross Country Troubles 26
Airman, Where Do We Go From Here? 30
From Picks to Props 32
Civil Aviation in Canada 36
Take-Offs with Heavy Loads 38
Simple Aerodynamics 42
Airplane Design and the Public 48
A Forced Landing in the Bahamas 50
Lighting the Airport 56
"Pre-War Stuff" 64
Sailplane Construction 70
Old Timers—and Others 77
Woman's Influence on Aviation 78
Toronto Flying Club 80
Repairs in Mid Air 86
Scientific Models 87
An Aviation Clearing House 98
Aeronautical Travel Bureau 99
Our Library and Yours 100
Financial Survey of Aeronautics 104
Directory 122
Patent Department 123
Advertisers' Index 129

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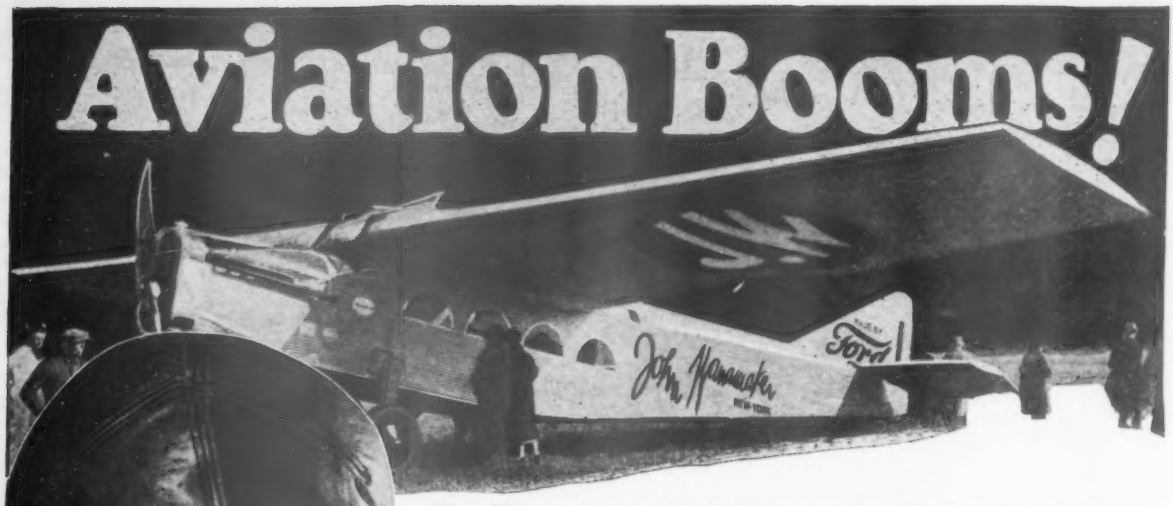
Aviation Booms!



The skies are dotted with daring young men—from every country come stories of new feats—new victories—new heroes! The golden age of Aviation has just begun—the future is almost too stupendous to be imagined! And now Aviation, with all its Fascinating Adventure, calls for Red-blooded young men—and will pay them splendid salaries! Read how some of Aviation's Pioneers will help you to qualify to get into Aviation—then send today for your copy of our FREE Illustrated Booklet, listing and describing the opportunities that await you.

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AERONAUTICS, the new name of Popular Aviation, makes its appearance for the first time on this month's cover. It is our belief that the thousands of readers whose interest have made this magazine what it is will welcome the change of name.

AERONAUTICS will gradually replace the name "Popular Aviation," which, having served its purpose, must give way to a title more in keeping with the character of the magazine and the interest of its readers and advertisers. The old name will appear with the new for a few months more until readers become accustomed to the change.

AERONAUTICS, as a title, has the advantage of a wider meaning. It reflects more accurately the purposes and policies back of this publication, which, in its comparatively short life, has attained a greater circulation, by forty per cent, than any other publication in the field.

AERONAUTICS, the magazine, does not contemplate any change in the policies, which, in part, have been responsible for its phenomenal growth, but rather an amplification and extension of these policies. The same readable type of articles will be continued, with the addition of more technical material of especial interest to those readers whose advice and support have been given so generously. There will be special features written by outstanding figures in the aeronautical industry.

AERONAUTICS will announce, next month, a policy inaugurated for the protection of both readers and advertisers, which we believe will have an important and far-reaching effect of great benefit to aeronautics.

AERONAUTICS is a peculiarly fitting title, as it was borne by one of the pioneer magazines, and now will be carried by the first magazine in point of circulation. We pledge ourselves to carry on the high ideals of those earlier men of vision who were handicapped by popular apathy and thus prevented from developing "Aeronautics" into the power it deserved to be. With your help we will make the new AERONAUTICS its true successor in every way.

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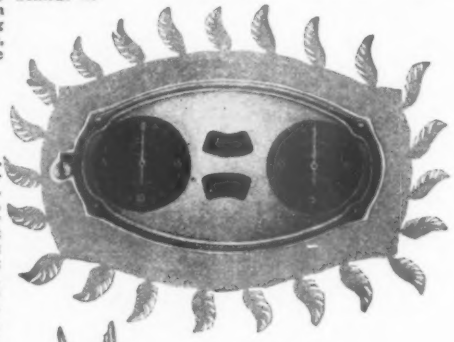

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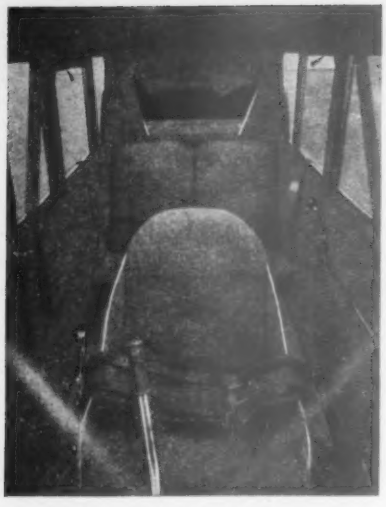
General view of International Aeronautical Exposition held in Chicago Dec. 1 to 9, 1928.

International Aeronautical Exposition

A HIGHLY significant demonstration of the progress which has been made in the development of commercial aviation in the United States during the last two and a half years, was given the world at large in the International Aeronautical Exposition which was held in the Chicago Coliseum, December 1 to 9, 1928. Seventy-eight planes were on display in the booths of 55 manufacturers and operators. Engines varying from the hexagon air-cooled 600 h.p. Curtiss Chieftain to the tiny Henderson motorcycle motor rebuilt for service in the Heath parasol were exhibited. More than a hundred companies showed aircraft accessories. In point of size, the Chicago exhibition was the most ambitious which has yet been staged anywhere in the world.

But more important than the mere number of planes and parts on exhibit was the fact that the exhibition represented almost exclusively aircraft developed and employed for civil use. Only four planes on the floor were designed for military purposes, and at least one of these was brought to Chicago as a substitute for a commercial type which the exhibitors intended to display. Military and naval aviation have rendered service of incalculable value to the cause of aeronautics, and will certainly continue to do so, but it is encouraging to consider that the point has been reached where strictly commercial stimulation is sufficient to promote the expansion and consolidation of the aircraft industry.

The interest taken by the public was very great. Besides those who attended the show for professional reasons, and excluding those who came in connection with the International Conference on Civil Aeronautics, held in Washington the following week, nearly 100,000 people viewed the planes. Persons of all degrees of aeronautical sophistication wandered through the exhibition halls, lingering before the booths, examining the airplanes, tapping the fabric on wings, and moving ailerons and elevators up and down.



Interior of Curtiss Robin monoplane, looking aft from pilot's seat to the passenger accommodations and luggage compartment.

Air-minded little boys, wearing aviators' helmets, made their way about with vast collections of printed matter. The crowds were cheerful, interested, and apparently for the most part deeply impressed by what they saw.

From the point of view of the expert, there was much to be seen. Several planes, recently announced and not hitherto publicly displayed, were in the exhibition. The Fokker amphibian, suggestive of European design in the mounting of the motor over the wing and in the frank marine lines of the flying-boat fuselage, attracted a great deal of attention. The amphibian is designed to fly at a high speed of 125 m.p.h., and to cruise at 100 m.p.h., with a landing speed of 50 m.p.h., and a climb at sea level of 950 feet per minute. Gasoline consumption is at the rate of 25 gallons per hour, and the cruising range is 5 hours. The power plant is either a Wright Cyclone 525 h.p. motor, or a Pratt and Whitney 500 h.p. Hornet.

The design of the landing gear on the Fokker amphibian is of considerable interest because it represents an attempt to eliminate almost entirely the parasite resistance ordinarily incidental to this part of airplane structure. In flight the wheels are retracted and completely withdrawn into duralumin stub wings, making the whole housing of some aerodynamic value. A more or less similar effort is made in the Simplex center wing monoplane.

Three new Fairchild models made their first appearance at the show. The 41, a four-passenger cabin monoplane with folding wings, was perhaps the most important commercially, but of at least equal interest were the 71, a six-passenger cabin monoplane, similar to the 41 though larger, and the 21, a low-wing monoplane designed for student-training. The plane is of especially sturdy construction, and embodies several safety features, including a landing gear with a tread of eight feet. The pilot and the student sit in tandem cockpits, so arranged as to afford the best possible range of vision. A five-cylinder, 80 h.p. Armstrong-Siddeley Genet radial motor is used.

Two foreign planes which attracted large crowds were the de Havilland Moth biplane, fitted with the famous Handley-Page slotted wings, and the Aeromarine-Klemm monoplane, with the tiny nine-cylinder radial air-cooled Salmson engine. Both are to be sold on the American market, the Moth being built and offered for sale by an entirely American company, with headquarters in New York. The Moth is powered with an 85 h.p. four-cylinder-in-line air-cooled de Havilland motor. Each of these planes has a well-established reputation abroad, the Aeromarine-Klemm having shown very well in the light plane races held at Orly, France, during September. The Moth has an impressive record of long distance flights to its credit, and has accomplished more in the way of really strenuous flying than perhaps any other light plane.

Among the more recently developed planes shown at the exhibition was the Command-aire biplane, built in Little Rock, Arkansas. Two ships formed the Command-aire exhibit, one being fitted with an OX5 motor, and the other with a Walter air-cooled radial 120 h.p. engine. Streamlined fairing aft of the cylinders in planes equipped with radial type motors, and slotted ailerons are features of the Command-aire models.

Open planes, for sport, pleasure, business, and training purposes, were very numerously displayed. One of the most striking exhibits of the show was the Waco 10 Sport model hung in a permanent banked climb at the north end of the Coliseum. On the floor beneath were two other Wacos, one a standard straight wing model, powered with an Hispano-Suiza, a 150 h.p. water cooled engine, and the other a Sport 10, similar to the plane hanging from the ceiling. The Sport Waco was used by John Livingston of the Midwest Airways in winning the 1928 Transcontinental Derby (Whirlwind motor class), and has taken several other important races during the past six months. It is a single-bay biplane of tapered "M-6" section, with a very wide center section. The plane is designed with a load factor based upon a power loading with motors up to 400 h.p., and is ordinarily equipped with a Wright Whirlwind J5 or J6.

An Alexander Eaglerock was displayed by the Trowel Post No. 160, Chicago, of the American Legion. This three-place biplane is powered with a Hisso A 150 h.p. motor, which gives it a high speed of 114.2 m.p.h., and a cruising speed of 100 m.p.h. Its fuel capacity is 70 gallons, and its normal range of flight is 575 miles.

Two Stearman biplanes, both equipped with Whirlwinds, and two Consolidated biplanes, fitted with Warner Scarab motors, stood across the north room from the Eaglerock, and near a Kreider-Reisner 150 h.p. Comet motored biplane. In the Coliseum proper were an American Eagle three-place biplane with a Ryan Siemens motor, and a Travel Air Whirlwind, also designed to carry two passengers and pilot. A Spartan open biplane, powered with a 120-125 h.p. 9-cylinder radial air-cooled Walter motor, stood in the south hall. Nearby were three Swallows, one of them being the OX5 T. P. training model biplane which lands at less than 30 m.p.h.

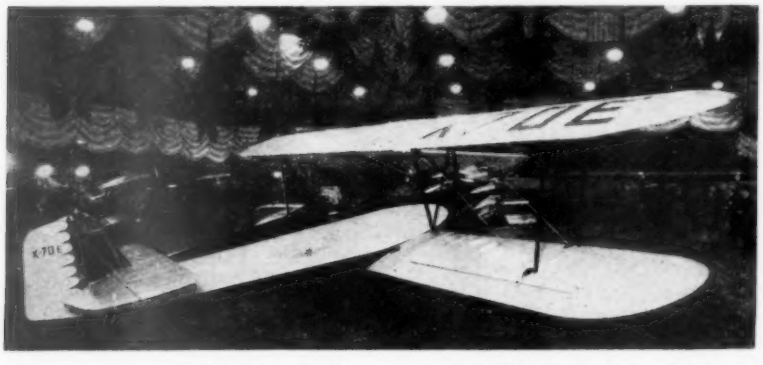
A Whirlwind Laird three-seater was shown in the Armory, as was also an Alliance Argo, powered with

Miss Jean La Rene standing beside the folding wing American Eagle light sport plane.

a 125 h.p. Hess Warrior 7-cylinder radial air-cooled motor.

Many other types of airplanes figured prominently in the great exhibit. There were very light biplanes and monoplanes, inexpensive to buy and easy to operate, large transport planes, amphibians with the appointments of a yacht, mailplanes, a flying boat, and aircraft intended for military service.

Possibly more interesting to the average visitor than almost any other type on display were the light, low-priced, two-seater biplanes and monoplanes, open and closed. In the Armory were the Driggs Skylark, and the Arrow Sport, both two-place biplanes. In the Arrow the passenger and pilot sit side by side; in the Skylark they sit in tandem cockpits. The Arrow is outfitted with a Le Blond 60 h.p. motor, while the Skylark employs its own 4-cylinder inline, inverted air-cooled 60 h.p. engine. Also in the Armory was the Heath parasol, small single-seater monoplane powered with an adaptation of the Henderson motorcycle engine.



Command-aire biplane with streamline fairing behind the Walter motor.

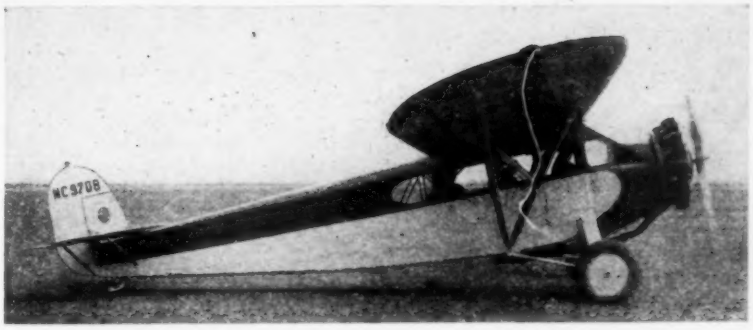
The Mohawk Pinto received its Approved Type Certificate from the Department of Commerce during the show. The Pinto is a two-seater, low wing monoplane, equipped with a Velie 60 h.p. radial air-cooled motor. The Cavalier, built by the Star Aircraft Company of Bartlesville, Oklahoma, also uses the Velie motor. This plane is a cabin monoplane, arranged to accommodate two people sitting side by side. Dual control is, of course, optional.

The Mono-Aircraft Corp. of Moline, Ill., had three models on display. The Monocoupe, a two-seater cabin monoplane, and a Monoprep, a two-seater parasol monoplane, both use the Velie 5-cylinder motor. The Monocoach flies the Velie 9-cylinder radial engine.

One of the few single-seaters at the exhibition was the Szekely Flying Dutchman, a low wing, open cockpit monoplane, made in Holland, Michigan. This plane is furnished with a Szekely 40 h.p. radial air cooled 3-cylinder motor, cruises at 80 m.p.h., and lands at 30 m.p.h. The motor is advertised to fly the ship 30 miles on a gallon of gasoline. A two-place biplane with folding wings, powered with either a Szekely 40 h.p. or a Le Blond 60 h.p. motor was shown by the American Eagle Company. This plane is notable for its low price and remarkable performance.

The Phantom Knight biplane, the Monarch OX5 biplane, the Mercury monoplane, the Wallace Touroplane with an OX5, and the Acme folding wing monoplane with a Velie motor were among the moderate priced ships on exhibition.

Planes designed for service with



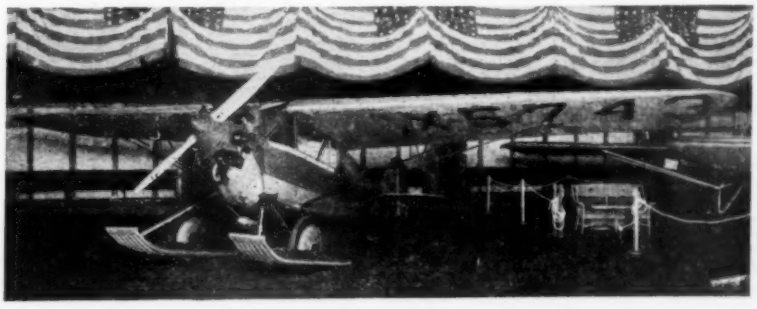
Fairchild folding wing cabin monoplane introduced at the Chicago show. This is the 71, a seven passenger transport.

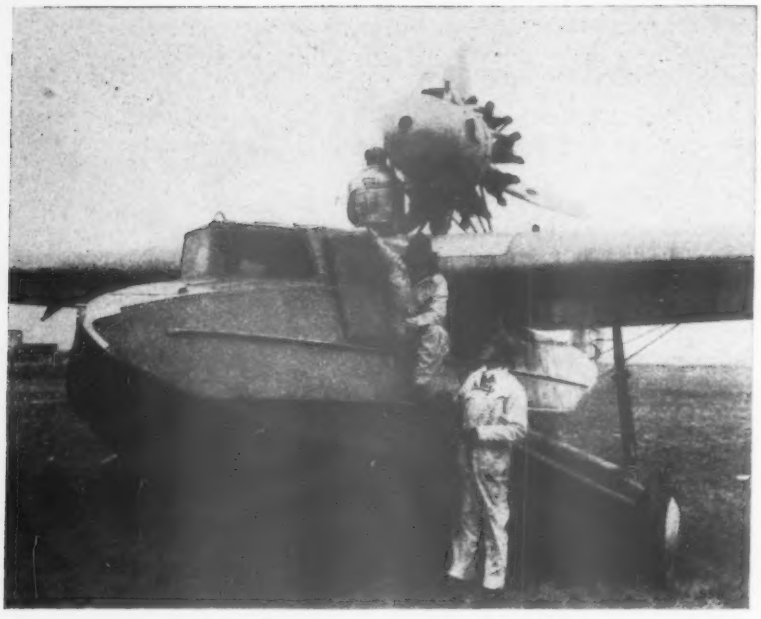
transport operators made up the largest single group at the exposition. Dominating one whole side of the Coliseum were two Ford trimotor all metal monoplanes. One of these was displayed by the National Air Transport, and the other contained an exhibit of canned goods arranged by Reid, Murdoch and Company. The N. A. T. plane is to be placed in passenger and mail service between New York and Chicago. Many a visitor to the aircraft show, weary with the responsibility of seeing and assimilating the whole exposition in one evening, permitted himself at least a quiet sigh at sight of a Pullman berth, fully made up with blankets and pillows, in the cabin of the "City of Columbus." The upholstery and furnishings in the cabin of this Ford transport are more suggestive of a club-car on a crack train than of the interior of an airplane.

The Reid, Murdoch grocery display is to be flown from city to city, showing grocers and customers different methods of displaying goods. About 500 cans of fruit, vegetables, sardines and other groceries, plain and fancy, make up the outfit to be carried.

Names familiar to everyone were

Mercury monoplane in the Armory, equipped with snow-shoes and wheels.





Anthony H. G. Fokker, designer, climbing out of the new amphibian after a test flight. At the right stands J. Steckel, project engineer.

represented in the cabin planes on view in the south end of the Coliseum. Two Ryan-Mahoney monoplanes, equipped with Whirlwind J5 motors, and in general construction very similar to "The Spirit of St. Louis," and a Bellanca Whirlwind monoplane of the type flown by Chamberlin to Germany, were prominently displayed. A Fokker Superuniversal, flying a total useful load of 2,150 lbs. at a cruising speed of 118 m.p.h., with a Wasp motor, stood near the Fokker amphibian already described.

Two Curtiss Robins, put on view by the Curtiss Flying Service, and the Curtiss-Robertson Airplane Manufacturing Company, and powered with a Curtiss water-cooled 90 h.p. OX5 motor, and a Curtiss 170 h.p. 6-cylinder radial air-cooled Challenger engine, were interesting to many. The Robin is a three-place cabin monoplane; powered with the OX5, it has a high speed of 100 m.p.h., and a cruising speed of 82 m.p.h. With a Challenger it flies at a top speed of 115 m.p.h., and cruises at 92 m.p.h.

Two Cessna monoplanes were the exhibit offered by Clyde V. Cessna of Wichita, Kansas. One was a four-passenger model, powered with a Warner Scarab engine. The other, a six-passenger plane, is flown with a Whirlwind.

Also from Wichita were the two planes of the Travel Air Company. Besides the biplane there was a cabin monoplane, equipped with a Whirlwind motor. The Travel Air monoplane is intended to carry two pilots and four passengers, at a high speed of 120 m.p.h. and a cruising speed of 105 m.p.h. The rate of climb is 700 f.p.m. at sea level, and the cruising radius is approximately 725 miles. A similar type of Travel Air monoplane, piloted by Arthur T. Goebel, won the Dole race to Hawaii.

Of special interest to a large percentage of those attending the exposition was the General Aircraft Company's Aristocrat cabin monoplane, displayed in the south room. This plane, with a Warner motor and slotted ailerons, is about to be put into quantity production. The General Aircraft Company announce plans for producing about 300 Aristocrats in 1929. Larger monoplane models are also scheduled to go into production during the year, and the company will build at least as many of the Courier eight-place transport series as of the smaller Aristocrats. The Aristocrat, a three-place cabin monoplane, is notable as the only small plane to be included in the equipment of the Byrd Antarctic Expedition.

Cabin biplanes were shown by E. M. Laird of Chicago, and the Butler Aircraft Corporation of Kansas City, Mo. The Laird plane is a six-place, Wasp motored transport, and the Butler biplane is a four-place, Whirlwind motored model. The Butler Aircraft Corporation feature semi-steel construction, in conjunction with spruce wing beams and fabric covering. Besides cabin biplanes and the Whirlwind three-place open cockpit model manufactured by the Laird company, and already described, one other Laird high speed plane is built. This is known as the LCR, and attains a high speed of 150 m.p.h., and a cruising speed of 120 m.p.h. It is a three-seater, open cockpit biplane, and is equipped with a Whirlwind J5. The J6 will give even better performance.

The bright orange Lockheed Vega which stood in the Armory attracted many visitors. Powered with a Wright Whirlwind motor, this ship is exceptionally fast. The high speed characteristic is the result of the extremely clean lines of the fuselage and wings. Rigid cantilever construction in the wing has eliminated struts, and the fuselage is almost perfectly streamlined. The plywood monococque material used throughout, heavily painted until its surface resembles the rich, hard finish of lacquer, gives the plane an attractive

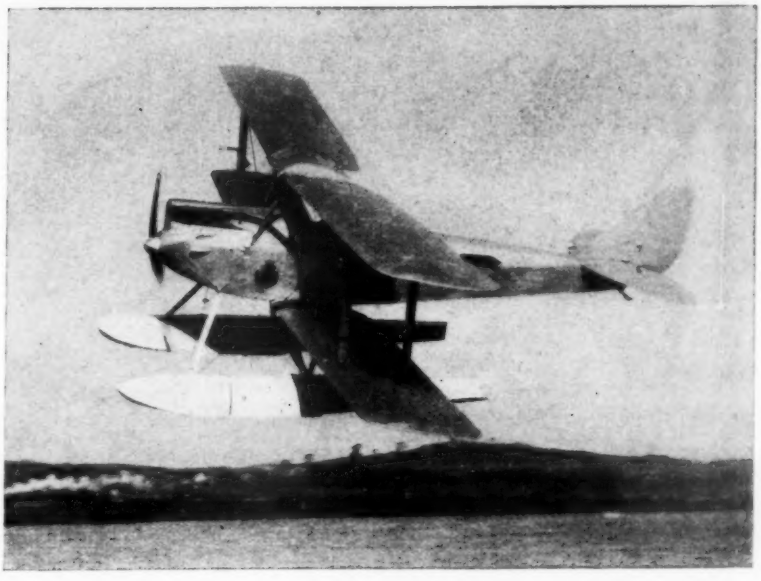
Three place Spartan biplane with Walter motor. Note the absence of stagger in the wings.

appearance. Capt. Sir George H. Wilkins has a Lockheed Vega with him in the Antarctic.

Two Stinson Detroiters, powered with Whirlwind motors, of the type used by Brock and Schlee in their Detroit to Tokyo flight in 1927, were on the floor near the Travel Air exhibit. The Stinson Detroiter is a general service plane, adapted for passenger and express carriage. The Thompson Aeronautical Corporation, operating a passenger, mail and express line out of Chicago to Michigan points, uses Stinson aircraft.

Appropriately placed close to the Ford all-metal tri-motor transport of the N. A. T. stood a Hamilton metal monoplane. This is the type of plane employed in the Chicago-Cleveland service of the Universal Airlines. It is entirely constructed of duralumin and steel, and incorporates in the design of its cabin interior every feature calculated to increase the comfort of passengers.

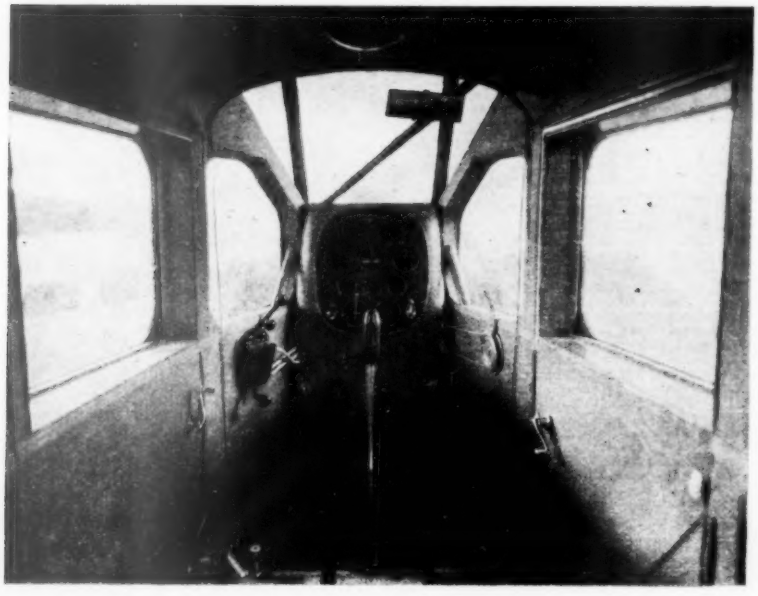
Air-mail is flown between Chicago and San Francisco by the Boeing Air Transport, Inc., of Seattle in special Boeing biplanes. From Seattle to Victoria Boeing Pacific Air Transport began carrying mail in a flying boat. A craft of this type formed the Boeing exhibit at the show. The hull and tail surfaces are of wood, giving the seagoing parts of the plane a very desirable resistance to the corrosive effects of salt spray. Equipped with a Pratt and Whitney Hornet motor, mounted with a pusher propeller above the lower wing, and providing space for a pilot, four passengers, and cargo, the plane is well adapted for transport service over large areas of water.



DeHavilland Gipsy moth banked in a turn over an English watercourse. The landplane type displayed at the Chicago exhibition had Handley-Page safety slots not shown here.

A mailplane was also exhibited by Pitcairn Aircraft, Inc., of Philadelphia. The Super-Mailwing is designed for high cruising speed, maneuverability, and economy of maintenance. It uses the Wright Whirlwind motor. Pitcarn Mailwings and Super-Mailwings are used on nine contract air mail routes.

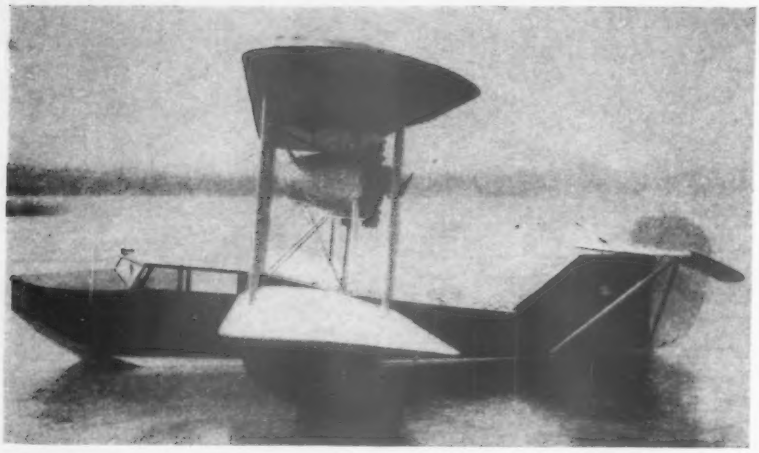
The Buhl display was composed of two Airsedans, one being the eight place cabin model, and the other the Special Airsedan with dual control and space for two passengers and baggage. This plane has a sharply tapered lower wing. The Senior Airsedan uses a Wasp, Hornet, or Cyclone motor, and the Special employs a Whirlwind.



Interior of Fairchild 71. The view is taken looking forward from the pilot's seat. Note the compact assembly of instruments.

Among the larger open planes was a Gates-Day Standard, which, like the Buhl Airsedan, is a sesqui-plane. The Standard is a three-seater, and stocks a Hisso 180 h.p. water-cooled engine. The two largest open models shown were the big Great Lakes biplane, built at Cleveland by the Glenn L. Martin Company for the Navy, and the giant Keystone Army bomber. Both planes were of very special interest. The Great Lakes exhibit was uncovered, to show the all-metal construction of wings, controls, and fuselage. Although the plane on display is intended for naval use, the Great Lakes company is adapting the type to commercial service as a passenger transport. The 74 flies on a Hornet or Cyclone with a payload equal to its own weight. Besides the 74 another model is soon to be made available, for combined mail and passenger transport. This plane will carry two pilots, five passengers, and will have in addition space for mail and luggage.

The Keystone bomber, fitted with two 450 h.p. Liberty water-cooled engines, was always surrounded by



Boeing flying boat with wooden hull and pusher type power plant.

a crowd of visitors, eager to know whether the long red bombs in the bomb-racks slung under the fuselage were alive or not.

The Keystone Aircraft Corporation, of Bristol, Pennsylvania, builders of the bomber, also manufacture the Patrician, a new 20 passenger cabin monoplane, with Pullman appointments and pursuit plane performance. Equipped with three Wright Cyclones, it makes a high speed of 151 m.p.h., and carries a pay load of 3,880 lbs. Through a recently consummated merger with the Loening airplane interests, the Keystone corporation now build the Loening amphibian, one of which was on display at the show. The Loening amphibian, with a Cyclone motor, accommodates eight passengers in its cruiser-like cabin, has a high speed of 130 m.p.h., and is equally at home on land or water.

Very great interest was shown in the amphibian planes presented at the exhibition. Besides the Fokker and the Loening amphibians, one a monoplane and the other a biplane, there was the big Sikorsky sesquiplane amphibian. This model, identified commercially as the Sikorsky Amphibion, is powered with two Pratt and Whitney Wasps or Hornets. The motors are mounted side by side, above and to the side of the passenger cabin. It has an overall span of 71 ft. 8 in., a length overall of 40 ft. 3 in., and a height of 13 ft. 10 in. With a capacity load of two pilots, eight passengers, and 680 pounds of cargo, it has a high speed of 125 m.p.h., a cruising speed (at 1,650 r.p.m.) of 110 m.p.h., and stalls at 55 m.p.h. It cruises five hours, or approximately 550 miles, with the standard gasoline supply, and climbs 880 ft. during the first minute of flight. Other features of the performance of this ship are its ability to fly and climb on either engine alone, and to thus continue the flight its normal distance even in the event of the cutting out of one of the motors.

Other than the Great Lakes-Martin Navy torpedo plane and the Keystone bomber, there were two military planes on display. One of these was the Navy fighter built four years ago by the Hall-Aluminum Aircraft Corporation of Buffalo. This plane was shown with its fabric stripped off to expose the metal structure. In spite of its four year service under conditions in the Navy, notably prejudicial to the life of an airplane, the plane showed almost no corrosion or other signs of decay.

One of the planes which could always be identified at a distance by the number of people waiting in line for a chance to look into the cockpit, was the Vought Corsair, with two gold stars on its fuselage, used by Rear Admiral William A. Moffett, U. S. N., Chief of the Navy Bureau of Aeronautics, as his high speed "office." The after cockpit is fitted with a small desk. The Corsair has long been one of the most important units of American naval aviation, but only very recently has it been offered the public as a high performance open sport or business plane. It is powered with a Wasp, and is normally arranged to carry one or two persons.

Scarcely of less interest to the general visitor than the planes themselves were the motors. Eighteen different manufacturers had their products on display. There were radial air-cooled motors shown by the Axelson Machine Company of Los Angeles; the E. W. Bliss Company of Brooklyn (Bristol Jupiter); the Curtiss Aeroplane and Motor Company of Garden City, Long Island; the Fairchild Aviation Corporation, Farmingdale, L. I.; K. G. Frank of New York (Siemens-Halske); Kinner Airplane Motor Company of Glendale, California; Pratt and Whitney Aircraft Company, Hartford, Conn.; Spartan Aircraft Corporation (Walter), of Tulsa, Oklahoma; Szekely Aircraft Corp., of Holland, Michigan; Velie Motors Corp., of Moline, Illinois; Warner Aircraft Corp., of Detroit, Mich.; and the Wright Aeronautical Corp., of Paterson, N. J. The Salmson and Hess-Warrior motors were shown in planes.

Air-cooled motors with cylinders

Geared Hornet 525 h.p. nine cylinder radial air-cooled motor in the Pratt and Whitney exhibit at Chicago.

in line were shown by Campbell, Peterson and Company (Cirrus), and installed in the de Havilland Moth (Gipsy). Water cooled line motors besides the familiar OX5 were on display in the Curtiss booth, and several planes stocked Hispano-Suiza's and Liberty motors.

The Pratt and Whitney geared Hornet 525 h.p. radial air-cooled motor was one of the most interesting offerings. The engine has a displacement of 1,690 cubic inches, develops its maximum rated horsepower at 1,900 r.p.m. crankspeed, and weighs 835 lbs. Its fuel consumption, in lbs. per h.p. hour, is approximately .60 at rated power, and its oil consumption is .035. Like the direct drive Hornet, the geared Hornet has nine cylinders, the bore and stroke being 6.125 inches and 6.1375 inches, respectively, also as in the direct drive model.

Much attention was paid to the new Wright series of J6 Whirlwinds. The 300 h.p. 9-cylinder motor is particularly notable, since it produces a fourth again as much power as its distinguished predecessor, the J5, though it weighs fifteen pounds less. Two other motors, both making their public appearance for the first time at the Chicago show, are of very great interest. The 7-cylinder Whirlwind has the same horsepower rating as the old 9-cylinder J5. At 2,000 r.p.m. it delivers 225 brake horsepower. The 5-cylinder model R-540 is listed at 150 h.p.

All of the new Whirlwinds have cylinders with a bore of 5 inches and a stroke of 5½ inches, giving a compression ratio of 5.1 to 1. Their displacements are as follows: 9-cylinder, 975 cubic inches; 7-cylinder, 756 cubic inches; 5-cylinder, 540 cubic inches.

J. H. Steenson (left), John MacPhail (center), and Roger Q. Williams (right), in front of the G. A. C. 3 place cabin Aristocrat.

The Velie L-9 aircraft engine, shown at the exhibition, has performed very satisfactorily in tests both in the Monocoach and in a Travel Air. It is especially designed for four-place ships and is furnished as standard equipment in the Monocoach. Bore and stroke are both 4½ inches, giving a piston displacement of 644 cubic inches. The compression ratio is 5.2, and the motor develops 180 h.p. at 1,900 r.p.m. The weight of the engine dry, without hub or starter, is 477 lbs. or 2.66 lbs. per h.p. Fuel consumption is at the rate of .55 lb. per h.p. hour.

Prominent among the motors of its class was the Warner Scarab, a 7-cylinder radial air-cooled engine developing 110 h.p. at 1,850 r.p.m. Many of the planes in the show, including among others the G. A. C. Aristocrat, the Cessna, and the Consolidated Husky Junior, were equipped with Warner motors. The Scarab took the first four places in the New York-Los Angeles Class "A" Air Derby the first three places in the Cincinnati Air Derby, Class "A," and third place in the National Air Tour, thus demonstrating very clearly exceptional reliability.

A very great variety of exhibits were assembled by the manufacturers of accessories. Instruments, maps, lumber, spark plugs, lights and markers, sheet metal, insulation, wheels and brakes, paints and dopes, clothing, spray guns, starters, tools, drop forgings, batteries, cameras, wooden and metal propellers, derricks, steel tubing, ball-bearings, goggles, seat cushions, unbreakable glass, fire extinguishers, windshield wipers, carburetors, and at least twice as many other products adapted in one way or another to airplanes or their operation were included in the accessories booths. Aviation schools, refiners of oil and gasoline, parachute, magneto, and fabric manufacturers all had representatives at the show. There was probably no department of utility and interest in the aeronautical industry without spokesmen and exhibits. Aviation in the United States is no longer merely adolescent; on its twenty-fifth birthday it can honestly claim to have reached its majority.

Stearman biplane with Whirlwind motor. This type is a high performance sport or mail plane.

Why Not Retail Airplanes?

By Robert S. Clary

THE airplane industry, in its growth and appeal to the public's imagination, is closely paralleling that of the automobile industry in its formative years. Much of the business history of the automobile undoubtedly will be repeated in the business of manufacturing, selling and operating airplanes. These two assertions are strong, it is true. But they are founded on rock-ribbed, irrefutable fact.

Thirty years ago, when the total annual automobile production of the United States was only 2,500 and the total registration just 3,200, no one would have dared predict that 46,254,631 Americans would learn to drive a motor car by 1928! At that time no business man would have dared prophesy that the then struggling automobile industry would in three brief decades increase the wholesale value of its production from less than five million dollars to the titanic total of $4,247,800,743 per year! No dealer or distributor would have even dared to hope that motor cars would ever constitute 11.6 per cent of the whole nation's entire retail business!

Yet, today we have 29,505,475 motor vehicles in operation daily transporting men, mail, money and merchandise. And leading economists predict that automobile history will be repeated in the airplane business. What does this mean to the present or prospective airplane dealer or distributor? It means golden opportunity. Let's examine this opportunity.

Aviation statistics for the past year are, of course, not yet complete; but it is believed that the volume of business of the principal airplane manufacturers will be about 300 per cent greater than in 1927, the former record year. And many feel certain that the 1929 output of planes will show as large an increase over 1928.

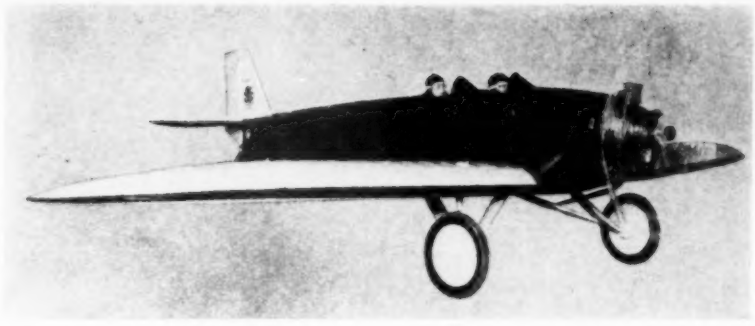
A leading statistical organization recently made a survey of the companies engaged in the airplane business—listing some 65 whose scale of production and earning power proved them worthy of being analyzed—and came to the conclusion that probably less than 20 of these manufacturers will account for 95 per cent of the 1928 output. Obviously a dealer or distributor franchise from one of these 20 dealers will be more valuable than a

franchise from one of the lesser companies—but all of these 20 have very valuable territories available; and there are 120 other airplane factories in America which have openings of pregnant promise for distributors and dealers.

Who can say how soon a franchise from any of these 140 American aircraft manufacturers will be just as valuable as the Buick franchises of C. C. Coddington of Charlotte, A. S. Eldridge of Seattle, H. S. Leyman of Cincinnati, H. E. Sides of Lincoln, G. G. G. Peckham of Cleveland, C. S. Howard of San Francisco, A. G. Randall of Salt Lake City, Grey S. Garber of Saginaw, H. K. Noyes of Boston, H. E. Pence of Minneapolis, C. L. Whiting of Rochester, or F. W. A. Vesper of St. Louis? These twelve pioneer Buick distributors, known today throughout the automotive world, are selling $140,000,000.00 worth of automobiles per year—and drawing down a fat commission on every dollar's worth they sell.

During the calendar year 1927, according to the United States Department of Commerce, the aircraft manufacturing industry proper produced 1,828 airplanes—valued at $14,131,225—an increase of 59 per cent over 1926. Moreover the department itself admits that this rapidly increasing demand for aircraft represents but the initial production of a new industry; for since the war, commercial and civil aviation has been operating mainly on war surplus.

The demand for modern planes, the diminution of war supply, the development of better engines, and the application of Federal inspection—combined with the widespread acknowledgment of the airplane in business life, promises an increase of which any estimate must be but a guess.



Fairchild 21 two place low wing training monoplane. The motor is an 80 h.p. five cylinder radial air cooled Armstrong-Siddeley Genet.

It is entirely possible, however, that by 1958—and perhaps by 1948—aircraft production in the United States will exceed 3,573,671 planes a year. This means $4,247,800,743 worth of airplanes, for selling which distributors and dealers will receive many millions of dollars in commissions.

"All right," you say. "I grant that the future of aviation is promising, but how about the immediate present? What are the opportunities right now for retailing airplanes?"

Let's see what some of the aircraft manufacturers have to offer.

The Mahoney-Ryan Aircraft Corporation of St. Louis, builders of Lindbergh's "Spirit of St. Louis," have an established distributing organization covering the entire United States and five foreign countries. They report an export business of nearly ten per cent of their total output and hope to increase this percentage during the winter months by concentrating on the Central American and South American markets. Their twenty-five retail outlets consist largely of incorporated air transportation and distributing companies, who, although they have invested cautiously, are nevertheless in the business to stay and have ample finances to carry them over any flat spots the industry may experience during the next five or ten years. Many of these dealers were former automobile distributors and dealers with a wide and varied experience in automotive lines. The majority of the distributors maintain downtown showrooms or offices in addition to the regular hangar equipment on the field and a field itself.

Since the construction of the "Spirit of St. Louis" the Mahoney-Ryan Aircraft Corporation has sold through its twenty-five distributing outlets $2,250,000 worth of planes. This represents 186 airplanes sold over a period of eighteen months. The leading distributor, The Mutual Aircraft Corporation of Los Angeles, with 11 western states in their franchise, handled the bulk of this distribution, the gross sales in their territory approximating $230,000. Since that time the growth of aviation in the west has made it impossible to handle that large a dealership; so they now have four states.

As to the actual earnings of a dealer, it is encouraging to remember that this is the one phase of aviation which makes pioneering much easier than was the case with early automobile dealers who found themselves financially unable to make a go of an automobile franchise. Airplane distributors can make their demonstrators not only carry overhead and sales expense but actually make a profit. The Mutual Aircraft

Swallow training plane. Equipped with an OX5 this plane has a high speed of 90 m.p.h., and lands at less than 30 m.p.h.

Waco 10 with Whirlwind motor. Note divided type landing gear.

Corporation, in addition to handling parts and service, maintains a freight airline between Los Angeles and San Francisco. They carry daily 800 pounds of newspapers for the Los Angeles Times from Los Angeles to San Francisco and Oakland, 400 miles distant, to be sold alongside the morning papers printed in those cities.

Other distributors are putting their demonstrators to similar uses, such as taxi airplane service, student instruction, cross country flying, and airlines. Occasionally an airmail contractor will take the agency for a plane at one end or the other of his route. The sightseeing air taxi service alone often nets a distributor $500 to $1000 during a single week-end.

Practically all airplane distributors are on a 20 per cent discount basis with the manufacturing companies. This discount often applies to accessories and parts used on the plane they handle. Some of the larger manufacturing companies require a thousand dollar deposit with each contract, and a clause specifying the number of deliveries to be made within a twelve months' period.

One plane a month will usually give the distributor the maximum discount. Manufacturers are liberal in their attitude towards contracts: if a distributor can not dispose of the number of planes specified in his contract, the manufacturer will send factory representatives into that territory to determine reasons for slow sales; and occasionally the factory representative can actually sell more planes than the distributor.

Thus far, Mahoney-Ryan sales have been on a deposit and cash upon delivery basis. A time payment plan, however, has been in effect for some time with many distributors, and the following is considered the correct way to handle time payments: The distributor takes a deposit on the plane, usually $5,000, the remainder payable in twelve months. The remaining $7,200 can be handled either by insurance or by a mortgage on property of the purchaser until the payments have been made.

"Within ten years, aviation will be more firmly established than the marine industry but not quite as well established as the automobile industry," predicts Mahoney-Ryan. "Furthermore, aviation will not take the place of the automobile. Within fifty mile areas the automobile will be the most practical method of transportation; from fifty to five thousand miles, airplanes will really hit their stride, but there are many in the older generation who will never ride in an airplane. Ten years hence is too soon a time to predict the general and absolute adoption of the airplane, but in twenty years we will wonder how the people of the last generation ever got along without it."

The Stout Metal Aircraft Company of Detroit, Division of Ford Motor Company, have no dealers handling the sale of Ford planes, nor do they have any financial arrangements for partial or time payments. At present their planes are all of the large tri-motored type which require a special contract. Their market, therefore, is limited to airlines and large corporations; and so far, all their sales have been handled either direct from their Dearborn office or in a few instances through Ford and Lincoln dealers. The Stout Company does not believe that the airplane manufacturer can afford yet to get into the actual part-time payment in the sale of planes, but believes this will be handled by finance corporations as is done in the motor car business. (In fact, this is already being done in numerous instances.)

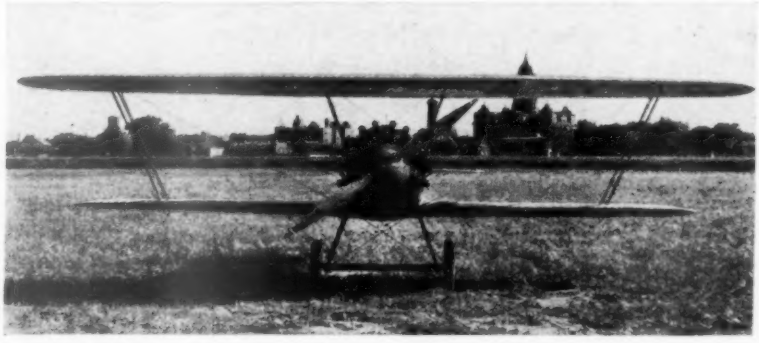
"There is a great field in commercial aviation—either from a selling

Governor-elect Kohler of Wisconsin beside the Ryan-Mahoney cabin monoplane in which he did most of his recent campaign travelling.

standpoint or from the operation end," the Ford Company further states; "and this opportunity is limited only by the capacity of the firm or individual tackling it. The advance in the use of airplanes for commercial work has been greater than that in any other line of commercial transportation in history during as short a period of time. We believe it is only in its infancy, and that the possibilities have hardly been scratched."

The Fairchild Airplane Manufacturing Corporation, of Farmingdale, N. Y., now has more than forty retail outlets; and since their present line is confined to two models, in order to maintain a selling organization their dealers have had to represent other planes at lower prices. Their terms today are 25 per cent cash with order and balance upon notification that the plane is ready for delivery.

In the main, this company sells through dealers, although they have just sent out three special representatives with planes on a tour visiting airports with two purposes in mind—good will, and demonstration of Fairchild products to prospective purchasers.



Whirlwind Waco with model 9 landing gear.

The company believes that the future of the individual or firm going into airplane retailing as a dealer or distributor, has the same future as the automobile offered twenty years ago—if the proper manufacturer is represented.

"Aviation is an infant giant," in their opinion. "Ten years hence, it will be taken as a matter of course—just as we accept today the telephone, radio and automobile."

The Curtiss Aeroplane and Motor Company of Garden City, Long Island, N. Y., one of the oldest aircraft manufacturers in America, for some time past has been producing mainly military aircraft. Now, however, they are entering the commercial field and developing a sales organization for this purpose. No definite information concerning their sales organization will be available until their plans have been more fully matured.

A similar case is that of the Glenn L. Martin Company, of Cleveland, which at this time finds its entire capacity taken up with the manufacture of Government planes for the U. S. Navy. At present they are working on an order for 102 three-purpose planes; but they expect to deliver commercial planes about two years hence.

The Advance Aircraft (Troy, Ohio) Company's method of selling Waco airplanes is through a system of distributors. The entire United States is covered under exclusive sales contracts by a group of 37 major distributors. Each of these distributors has a number of associate dealers in his territory, depending upon the logical market divisions of the territory.

American Eagle airplane with OX 5 motor.

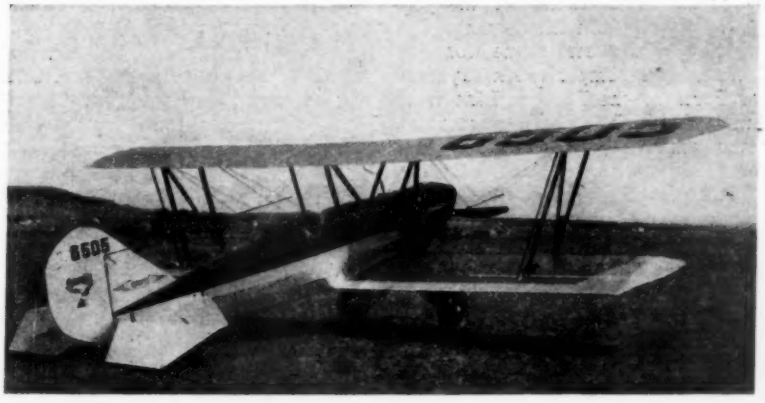
It has been this company's policy to refrain from appointing too many dealers in a given territory, as their first interest is to make sure that each distributor and dealer is finding the selling of Waco airplanes profitable to himself. In some parts of the country, this means large territories for dealers; in other parts, it may mean the more intensive working of a smaller territory.

One of their distributors, the Midwest Airways Corporation of Aurora and Monmouth, Illinois, and Waterloo, Iowa, has a list on the bulletin board of 107 new Waco airplane sales. The distributor at Buffalo has sold approximately 60 Wacos.

Although Waco sales to distributors and dealers are strictly

(*Continued on page* 113)

Alexander Eaglerock powered with a Hisso A water-cooled engine.



Denmark in the Air

Dornier Super-Wal flying boat at the dock at Kastrup Field, Copenhagen.

By Paul E. Lamarche, Jr.

THOUGH air lines connecting Denmark with the Scandinavian Peninsula and the Continent have been in operation for some time by foreign companies, the establishment of a Danish air line has been comparatively recent. In the spring of 1926 the Det Danske Luftfartselskab A.S. was formed with a government subsidy to finance it and during the first few months of its existence made several experimental flights to determine how it could best serve the public with its small fleet of planes, most of which at that time were five passenger Fokkers. Among these experimental flights was one made in April of 1926 to Amsterdam by way of Hamburg from Copenhagen which had as its object investigation of the possibilities of establishing such a line to allow quick air connection for London by the Imperial Airways and for Paris by the Farman Line from Amsterdam. The Danes were at all times anxious to establish a quick service between these two cities and Copenhagen. Ordinary transportation between Copenhagen and Paris requires about twenty-six hours while the commercial aeroplane can accomplish this journey in eight. An even greater amount of time can likewise be saved by the use of the air service to London.

Service for passengers on the Danish Line was postponed until later and it was arranged with the International Air Traffic Association, of which the line are members, that they would be able to make the connections with the same two foreign air lines for London and Paris at Cologne. There was some delay before this Copenhagen-Hamburg-Cologne service could operate, for a permission to fly over the Ruhr District was necessary. This was finally granted to them by the Commission Aéronautique Interalliée and the line was opened for the transportation of passengers, mails and freight on May 19th, 1926.

Since then the service of the Det Danske Luftfartselskab, or D.D.L. Line, as it is popularly called, has eliminated the stop at Cologne and connections for London are now made at Hamburg, where the air traveller changes to a Dutch K.L.M. plane and reaches England by way of Amsterdam. For Paris the traveller has a choice of routes at Hamburg. He can either take the K.L.M. Line of Holland and fly from Amsterdam to Paris or take a Luft Hansa plane at Hamburg and fly on German wings to Paris by way of Dortmund and Cologne. At Cologne connections with the Farman Line for Paris can also be effected. It can be seen therefore, that there is little room for further extension of the Danish services on the Continent. The present service between Copenhagen and Hamburg is, however, a very popular one and well patronized. During the summer months prospective travellers are often turned away and it is frequently necessary for the traveller who wishes to go by air to make his reservation on one of these planes in advance for almost always the planes carry their capacity loads with a full complement of passengers.

As in the rest of Scandinavia, there are no commercial air services in operation during the winter months since the weather is usually too severe for the maintenance of any regularity of service and travel is insufficient to warrant it. During the summer months, however, a number of airlines call at Copenhagen in maintaining services to Norway, Sweden, Germany and Holland, most of which allow connections at Continental airports making Copenhagen important as a part of the network of air lines that spreads out over Northern Europe. There are two daily services in each direction between Copenhagen and Hamburg operated by the D.D.L. Line in the summer. The first of these begins operations on the 10th of April and teh second on the first of June, while both continue until the 30th of September. In 1926 Danish planes flew

a total distance of 203,954 kilometres and carried 1,032 passengers, 26,803 kilograms of freight and 1,079 kilograms of mail. In 1927 a distance of 187,798 kilometres was flown, and 1,630 passengers were carried together with 37,864 kilograms of freight and 5,931 kilograms of mail. The decrease in the distance flown during 1927 is due to the fact that service to Cologne was discontinued, the Danish planes flying only as far as Hamburg.

The trip between Hamburg and Copenhagen as flown by the Danish and foreign planes is in itself an interesting one. The writer recently made this trip of 288 kilometres in a Farman Jabiru sesqui-plane used by the D.D.L. Line. Starting from Fuhlsbüttel Field, the Hamburg airport, the route takes the voyagers over that part of Germany known as Oldenburg, a flat country, some of which is used for farming although the soil is not particularly adaptable for extensive tilling. No towns of importance are to be seen and after about a half hour in the air the sea is reached and the coast of Germany is left behind. After passing over a short stretch of open water the German island of Femern is passed and the plane heads out over a sea which the Danes call the Oster Soen. One often passes other planes flying from Copenhagen to Hamburg and other cities over this part of the airway and as the writer flew over this route another Danish plane and later a Swedish Junkers of the A.B. Aerotransport Company from Malmo enroute to Hamburg and Amsterdam passed at close range. One is able to see many fishing vessels below on the sea and often the railroad ferry connecting Germany and Denmark can be seen making the crossing at this point. On approaching the shore again the word Danemark appears in large white letters on the shore thus identifying the country from the air. The town of Maribo is next seen and another stretch of open sea looms ahead, this being known as the Smaallandshavet by the Danes. On gaining the shore again near the small town of Vordingborg the plane continues over considerable flat country which is typical of the general topography of all of Denmark. After passing the town of Koge the plane flies out over a large bay known as the Koge Bugt until the Island of Amager is reached, upon which is located Copenhagen's airport known as Kastrup Field. Here the plane after describing a wide circle that takes it out over the Oresund Bay which forms a side of the field, lands after a flight of exactly two hours.

Kastrup Field is Denmark's principal civil airport and is the only one used by the International air lines.

View over the Danish coast en route to Sweden.

Its location is ideal and it is able to serve both as an airport to land planes and flying boats since the eastern extremity forms the shore of the Oresund Bay, a small body of water lying between Denmark and Sweden. It is situated at the extremities of the small village of Kastrup, a short and convenient distance from the center of Copenhagen. On the field is found an administration building, hangars, and a smaller building used as a restaurant, beer garden and place to entertain the many visitors who come out to watch the aeroplanes. On Saturdays and Sundays this latter building is very well patronized for usually crowds visit the field, many of whom like to take short flights in the vicinity of Copenhagen. This patronage is regarded as a good sign of the growing interest in aviation among the Danish people and is encouraged by propaganda as much as possible. At one end of the field is the Rohrbach plant where formerly large flying boats and other Rohrbach products were built. Beyond this is a small pier with a short concrete incline under the water at which flying boats used on the routes between Germany and Scandinavian cities arrive and depart. The Kastrup Field is owned by the Danish Government and is used by both military and civil aeroplanes. Among other air fields in Denmark are those at Avedore, Christianshaven, Lundtofte, Ringsted, Tonder and Aarhus, all of which are used by the Army air service, while Ringsted and the Marienens Flyvebaadsstation, situated near Copenhagen, are used by the Naval air forces.

During May of 1927 an interna-

Side view of a German Dornier Super-Wal flying boat as used by the Luft Hansa in the Travemunde-Copenhagen-Gothenburg-Oslo service.

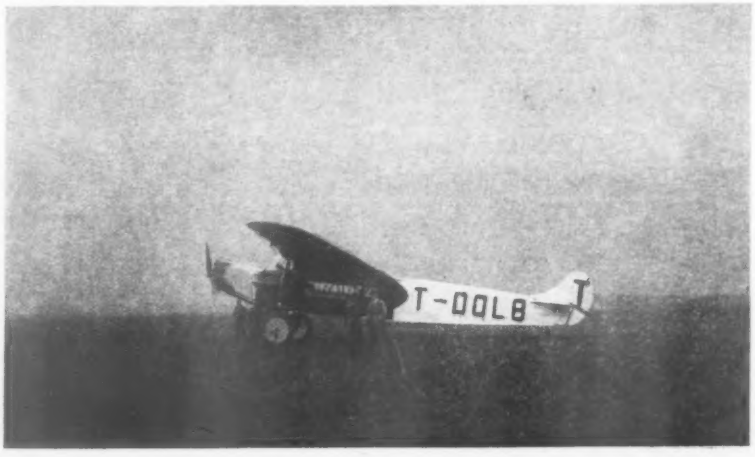
A Swedish Junkers of the A.D. Aerotransport Company used on the Malmo-Copenhagen-Hamburg-Amsterdam line.

tional aeronautical exhibition took place in Copenhagen which attracted much attention among the northern countries of Europe. A number of foreign countries exhibited planes and motors at this exposition and France, England and Germany were well represented. Such expositions go far towards boosting aviation in small countries for they not only attract attention and create interest among the natives but attract attention among outsiders as well which serves to bring about a greater recognition of their efforts.

Originally the D.D.L. Line used older types of five passenger Fokker monoplanes on their passenger service but they have acquired new flying stock within the past two years. The first three five passenger Fokkers have since been retired and are now used about Copenhagen for short flights while new eight passenger Farman Jabiru planes have replaced them. Likewise they have purchased Fokkers of the latest type which also carry eight passengers. The Farman Jabiru monoplanes are now built in Copenhagen by the Orlogsvaerftet (Royal Dockyard) plant, which has obtained the license from the French although some of the planes now being used by the Danish air lines were built in France. The Farman Jabiru as used by the D.D.L. Line is a large thick wing monoplane furnished with four 180 H.P. Hispano Suiza motors mounted in tandem, two on either side of the fuselage. The Orlogsvaerftet plant, which is the principal government aircraft plant besides building the Farman Jabiru planes for the commercial services builds Hawker "Danecocks" for the military service under license, as well as various adaptations of German planes for the naval services. As has been mentioned, there is located adjacent to the Kastrup Field a Rohrbach plant. This plant, which bears the official name of the Rohrbach Metall-Aeroplan A.S., rented 22,000 square metres at Kastrup and erected a plant which has been used for the building of two principal types of Rohrbach planes, the Rohrbach Rodra and the Rohrbach Rofix. The Rodra is an all metal monoplane flying boat equipped with two motors and built for naval purposes while the Rofix is a small single seater parasol monoplane for army pursuit work. This plant has also built large flying boats for the Japanese Navy. At present the Germans are discontinuing work here since Rohrbach planes are henceforth to be constructed at the Berlin works and assembled and flown at the big marine airport at Travemunde on the north coast of Germany.

A Fokker VII-A in the service of the Det Danske Luftfartselskab A. S. at Kastrup Field, Copenhagen.

Principal among the foreign air lines calling at Copenhagen are the Dutch K.L.M. Line, the Swedish Aerotransport Line and the German Luft Hansa. The K.L.M. operates an air service between Amsterdam-Bremen-Hamburg-Copenhagen and Malmo in Sweden. The new twin motor Fokker VIII monoplanes are used on this service and have become very popular on all of the Dutch routes. The Swedish Aerotransport fly their big tri-motor Junkers, which are built by the A.B. Flygindustri in Limhamn, Sweden, under license, over the same route as the K.L.M. Line and in conjunction with their service. The Deutsche Luft Hansa has several air lines which call at Copenhagen, among which is the one operating between Cologne-Dortmund-Hamburg and Copenhagen, another between Stettin and Copenhagen, and a third between Travemunde-Copenhagen-Gothenburg and Oslo. On the last two of these air routes the Luft Hansa uses Dornier Wal and Super-Wal flying boats which have attracted much attention and which are wonderfully adapted to the services in which they are used. The Dornier Wal is a big all metal twin motor flying boat while the Super-Wal is a somewhat larger flying boat of the same design equipped with four motors. The Super-Wal might be said to represent the last word in German commercial aircraft for the water and together with the Rohrbach commercial flying boat it is one of the finest flying boats seen in Europe. The performance record of these big boats is well known and they have given excellent service on the Baltic and other coasts in Northern Europe. The interior of the Super-Wal is divided into two compartments for the passengers with a separate section for the pilot and mechanic between them. The passenger quarters are



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well furnished and comfortably arranged and travel in these big planes is able to offer all of the comforts and pleasures of a modern Pullman car. The service between Travemunde-Copenhagen-Gothenburg and Oslo in Norway is in operation from the 14th of May until the first of September.

In Scandinavia the distance between cities is often greater than between Continental cities, and in Denmark, which is largely surrounded by water, travel requires much time, so that the aeroplane has come to play an important part in international transportation. To travel from Copenhagen to Gothenburg in Sweden by other means takes considerable time but the Dornier Wal flying boat can carry its complement of passengers over the Kattegut sea to this Swedish seaport in an hour and forty minutes. People in the northern countries are becoming more and more air-minded and the use of the aeroplane is increasing rapidly. Though German, Swedish, Dutch and Danish planes all carry passengers between Hamburg and Copenhagen people are frequently being turned away through lack of accommodation. This route is very attractive to the northern Europeans and has very much the same appeal to the traveller as does flying across the English Channel to avoid the boat trip as well as the train. It is not likely that the D.D.L. Line will extend its services any further on the Continent but additional internal lines are probable.

A Farman Jabiru in the D.D.L. service between Copenhagen and Hamburg. These four motor monoplanes are built under license by the Orlogsvaerftet works in Copenhagen.

Front view of a Dornier Super-Wal at the Kastrup Field landing stage in Copenhagen. This all metal flying boat is powered by four Rhone-Gnome-Jupiter motors.

Fog Piercing Beacon

One of the greatest existing hazards to aviators is fog. This may lose some of its dangers, however, as a result of the development by the General Electric Company at Schenectady of a new type quartz neon-gas filled lamp of low voltage as an airplane beacon. Since red light waves are longer than white light waves, the research engineers who have been working on the problem hope that it will be more effective in penetrating fog. This lamp, which resembles a ball of reddish orange fire when in use, emits practically all its visible radiation in the longer light wave lengths. At a test, when an unusually heavy fog settled about Schenectady and buildings could not be seen at a distance of 500 feet, the red glow of this new light could be vividly seen for a distance of a half mile.

The voltage on which it operates is practically the same as that of a house current, whereas previous types of neon lamps such as are used in big signs require a very high voltage, often running to 15,000 volts. Such voltages are not only dangerous, but require special equipment to produce them.

In some respects the new quartz neon lamp resembles those used in advertising signs. The neon gas is rendered incandescent in a quartz tube by the low voltage current, developing a 4,000,000 candlepower lamp. The new beacon will offer a very sharp contrast to present lights in use, its chief value being its color, seen at a great distance.

The low voltage is made possible by a hot cathode which supplies sufficient electron emission in the lamp to furnish the current for the luminous discharge, and this low voltage will also tend to lengthen the life of the lamp. "We have also learned," says C. G. Found, who developed the new lamp in the General Electric's research laboratory, "that there is less tendency for the neon gas to disappear and blacken the lamp when low voltages are used. One of these hot cathode lamps has now operated for 3,000 hours without attention.

"This lamp consists of a small quartz tube wound in a close spiral 1½ inches in diameter to produce a greater concentrated brilliancy so that when the lamp is placed in one of the standard 24-inch airport beacons or searchlight reflectors it will produce a narrower and more penetrating beam than if the light source were larger."

"We don't yet know how far this red light can be seen," says Dr. Saul

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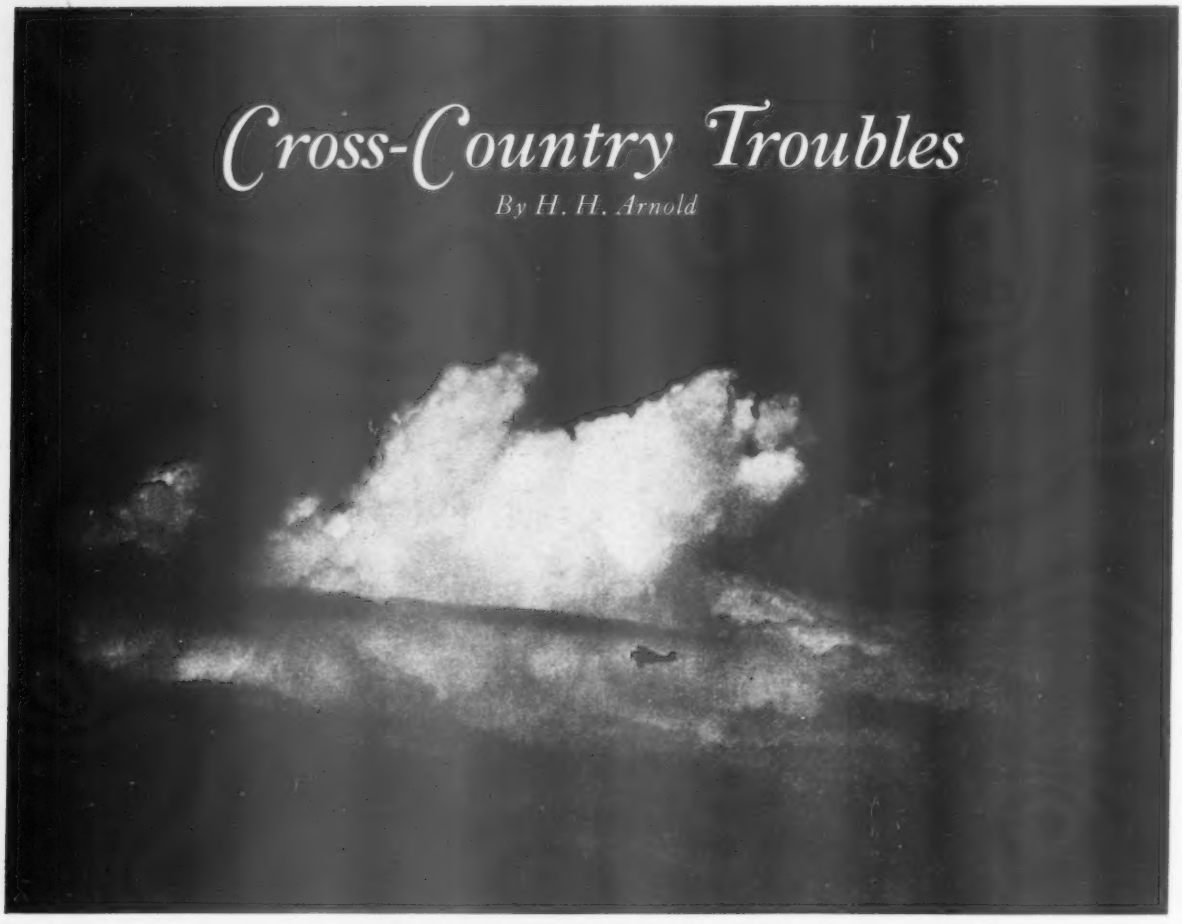
Cross-Country Troubles

By H. H. Arnold



Storm areas are marked by towering thunderheads above, and dark rain clouds below.

BACK in the early days of aviation when the distance that a pilot could fly depended upon the length of time that his engine would stay together, almost any flight beyond the limits of the flying field was classed as a cross country flight. Thus in the government tests of the Wright plane at Ft. Myer, Orville Wright and Lieutenant, now General, Foulois received credit for a cross country flight when they flew from Ft. Myer to Alexandria and return. The total distance covered was but a trifle over ten miles.

Wilbur Wright's flight from Governor's Island up the Hudson to Grant's Tomb and return in 1909 was epoch making. The following spring Glenn Curtiss achieved the seemingly impossible when he flew from Albany to New York. Bleriot made history in 1909 by flying across the English Channel even though he did make a crash landing at the end of the trip.

The cross country flights of those days were limited by the nerve of the pilots and the reliability of the extremely crude engines. Cross country flying was something new. The pilots had to fly over strange terrain in cranky airplanes propelled by temperamental engines.

At this writing, cross country flights are the rule and airdrome flying the exception. Flights of a thousand miles or more are accepted facts and are made with almost monotonous regularity. The airplanes and engines have been improved to such an extent that the pilot expends very little mental or physical energy in flying.

Landing fields and airports have been established by practically every city and town of moderate size. Thus the pilot knows that no matter in which direction he desires to fly, there will be a suitable landing field with servicing facilities awaiting him at his destination. Normally it makes no difference whether he reaches the end of his trip during the day or night for most of the airports are equipped with landing lights and beacons. Then too, the airways connecting the airports have signal lights marking the route at regular intervals. The pilot is seldom out of sight of one of the beams.

The cockpits and fuselages have been designed so as to afford the maximum comfort for pilots and passengers. There was a time when the upper part of the aviators' bodies extended so far above the cockpit that the airmen were always exposed to a terrific blast of air. The air pressure on the face became very trying after a short time in the air and it was remarkable that the pilots were able to make the flights that they did.

Today instruments have been provided for practically every purpose. The pilot by watching his instruments can fly for long distances without even looking at the ground. His compass keeps him on his course, the altimeter gives him his height above the ground and the bank and turn indicator tells him if his plane is on an even keel and flying level.

There is still, however, an element of risk and danger in cross country

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flights. The weather is not always perfect. Rain, snow, low clouds and fogs present ever changing problems for the aviators to solve. Two aviators approaching the same storm area may get entirely different reactions from the conditions confronting them. There are several things that can be done. The pilots have the choice of turning around and going back, landing where they are, flying over the storm, flying around it or pushing through in spite of the dirty weather. As a general rule the mission of the pilot influences his actions.

If time is an important element, the pilot usually tries to push through the storm or fog. If he is running short of gasoline or it is getting dark and he is still far away from a good airport he probably lands his plane in the first available field. If he has plenty of gasoline and is not in a hurry, he may try to fly around the storm to his destination.

Out in the Middle West storms come up with startling rapidity during certain seasons of the year. An aviator may leave an airdrome with perfect flying conditions only to find that he has reached an area in which he can not see any signs of the ground before he has flown a distance of fifty miles.

Normally there is no great difficulty in making cross country flights over the wide open plains of the Mississippi Valley. The section lines ordinarily are so well marked that the pilot does not need to use his compass. On the other hand the distances are very great and it is not unusual to fly for two or three hundred miles without seeing a single town. Thus, this particular section of the United States presents two of the extremes in flying conditions,—the easiest to fly over and the most trying.

To illustrate my point, a cross country flight between central Kansas and Superior, Wisconsin, will be recounted. The distance is about 600 miles. The terrain between the two places has no high hills, the highest being less than five hundred feet in height. There are numerous rivers and railroads for the pilot to check his location against. Section lines make it quite simple to follow a course. The weather conditions over this route may change so rapidly, however, that the actual flight will take much longer than anticipated when starting out.

On this particular flight, the sky was overcast at the pilot's home airdrome. He had a ceiling of about 800 feet. This continued for about ten miles and then he was flying along at six, five, four and three hundred feet above the ground. Suddenly the clouds in front dropped down to the ground. The aviator tried to find a route by which he could see the ground and yet have sufficient room to clear the trees, but with no success.

He turned to fly back to his airdrome and found the weather getting thicker as he progressed. He finally landed after flying through a heavy rain. Within two hours the clouds broke and he took off again. For fifty miles he flew through broken clouds and had almost perfect flying conditions.

As he approached the Nebraska state line, the weather became thicker. He was forced to fly through one rain squall after another. They were all small and did not present any difficult navigation problems, for the rain was light. The farther north he traveled, however, the worse the weather became. The rain became much harder and the storms larger in extent. It was necessary to fly close to the ground in order to stay on the course.

Major Arnold, the author of this article, was one of the two lieutenants detailed in 1911 to take flight training with the Wright brothers at Dayton. At that time there were but three aviation schools in the entire United States.

Even the heaviest rain has no effect on the operation of an airplane or its engine. It does, however, make the pilot's work much harder. The water flows back along the sides of the fuselage in a perfect stream. The rain drops strike the pilot's face at a speed of about a hundred miles an hour and sting much the same as if they were small stones or gravel. If the rain becomes exceedingly heavy, it is almost impossible for the pilot to see the ground, as the water forms an impenetrable curtain.

Omaha was reached after running through several squalls and dodging around several more. Ahead was a thick black cloud which extended to the east and west as far as the pilot could see. Lightning played through the clouds at short intervals. The pilot knew that he was going to have some trouble before he reached the other side of that storm.

The weather map for the day indicated that the storms should all be of small size and accordingly fairly easy to fly through. The pilot was confronted with a situation which could be met in one of two ways,—he could return to Omaha and land, or try and fly through the storm. He could not fly around as the storm clouds extended too far. He could not fly over as thunder storms have a violent disturbing effect on the air which extends for thousands of feet upward.

As time was an important element, the pilot decided to fly through. The clouds became blacker as he came closer. Here and there he could see the golden-greenish tint which always announces the presence of hail. Lightning was playing through the clouds in all directions around him. Then he and his plane entered the inky blackness and he lost all view of the ground. The rain came down in torrents and the disturbed air threw his plane around as if it were a feather. The streaks of lightning seemed to dart through the sky within a few feet of the plane. The pilot wondered if it were possible for a plane flying through the air to be struck.

There are few if any hills in the middle west that are over a thousand feet high. Hence as long as an airplane can maintain an altitude of twelve hundred feet or more there is no danger of crashing into the ground. Accordingly, the pilot kept his head inside the cockpit and flew by instruments. He had difficulty in keeping his course as the disturbed air threw the plane up and down, to the right and left, on one wing and then the other. It was a trying condition but not an exceptionally dangerous one as long as the plane could be kept in the air.

Although such conditions seem to endure hours when one is flying through them, they usually last but a few minutes. In a comparatively short time, this plane was again out in the open. There were intermittent squalls ahead but the violent thunder storm had been successfully passed.

During the next hundred miles it was possible to fly around other thunder storms, go through the smaller squalls and thus make some headway toward Superior. The wind became more gusty and this indicated a more disturbed condition somewhere in the vicinity. Suddenly the plane received an exceptionally violent jolt. It was just as if it had been thrown toward the

ground by human hands. The pilot looked upward to see what had caused this unexpected bump and saw the sky covered with cyclone clouds.

When there is a cyclone in the vicinity, the clouds take on a form peculiar to that condition. The clouds are kidney shaped with countless hemispherical masses boiling around close to one another. This condition exists on the outer edges of the cyclone area. The funnel shaped cloud formed by the cyclone itself is somewhere in the inner part of this peculiar cloud formation. The wind increases in velocity as it gets closer to the funnel. The air is alarmingly rough anywhere in the area. These disturbances usually travel fairly steadily from the southwest toward the northeast and accordingly can be dodged by airplanes.

Knowing that under such conditions the air is normally much more turbulent at high altitudes than near the earth, the pilot immediately dropped down close to the ground. As he descended, he looked around to locate the center of the storm. Off to the east the air was black as night. Lightning was flashing almost continuously. It was a safe bet that this was the portion of the storm to get away from.

The centers of such storms travel at about seven to twelve miles an hour although the winds in their immediate vicinity have velocities of over a hundred miles an hour. Thus it is possible, if a plane is not too near the center and thus in the area of greatest wind velocity, to run away from a cyclone.

The pilot turned his plane to the south for the chances were all against the cyclone traveling in that direction. It should get farther and farther away all the time. The violence of the cyclone was such that the pilot entered the rain storm ahead of him without the least feeling of misgiving. The worst cloudburst could not have the dangers and perils of a cyclone. Fortunately the cyclone was of small size and its effects more or less local. The pilot now felt safe but he knew that there were anxious moments ahead for those on the ground in the path of that rapidly rotating funnel.

Flying over a sunlit fog area the pilot is dazzled by what appears to be a vast snow field.

Within a few moments, the airplane was flying through a torrential downpour of rain. It seemed as if the heavens had opened up in an endeavor to force the plane to the ground with the very weight of the water. The airmen could not see anything beyond the inner wing struts. Everywhere they turned the forces of nature seemed to be pitted against them. There was no chance of reaching Superior that night.

As such heavy rains are normally of short duration, it was not long before the plane reached an area of comparative calm and light rain. A partial circle of the plane was sufficient to locate a cow pasture near a small town. By this time there were heavy rains in all directions, the cyclone was some fifty or more miles to the north almost directly on their course, they had wandered many miles trying to dodge rainstorms and had used up many extra gallons of gasoline, and could not have reached their destination even if there had been clear weather ahead. Accordingly, they could do nothing else but land.

The airmen had no idea as to their actual location. The instruments and maps in the plane, and the section lines, and geographical features on the ground would have shown them their exact location under normal conditions but they had flown through extremely abnormal weather. It made no difference now, however, for their flight for the day was over. In a few minutes the plane was on the ground and the engine and cockpits were protected by canvas covers.

The airmen had barely fastened the last rope, when the heavens opened again and rain came down in torrents. They sought shelter under the wings of the plane but the wind blew the rain almost horizontally along the ground. They were soon soaking wet. With the rain came thunder and lightning and they wondered if they had been right in their prediction as to the course of the cyclone.

A few men and children came out from the surrounding farm houses in spite of the muddy roads and wet weather. The airmen knew that they were somewhere in northern Iowa and learned the name of the small town, a place with a population of 800, from the inquisitive spectators.

After a ten or fifteen minute ride, the airmen reached the only hotel in the town. They were now in a dry shelter, with their plane staked down and covered so that no amount of rain could affect it. Then, as if to show the perversity of the elements of nature, the storm broke. The sun began to shine through the floating clouds and everything became brighter. It was too late by this time to continue on their journey for in an hour or two it would be dark.

Small towns in the middle west rarely if ever have the comforts that are found in the larger cities. This small town in Iowa was no exception to the rule. Nevertheless it is surprising how palatial even the most old fashioned and crudely appointed hotel room with its crockery water pitcher and wash-bowl can appear under certain conditions. Thus it was that the two airmen were satisfied and contented after their nerve racking flight. They were glad to be able to rest their heads anywhere and the musty bed linen, the damp bed and the lack of modern conveniences

had no effect upon their ability to sleep.

The next morning they were on their way with the sun shining, the sky cloudless and the air calm. The weather man had predicted scattered clouds and occasional rains the day before and the airmen had run into almost every kind of weather. Today everything looked as if the flight might be completed uneventfully.

It is well, however, never to take anything for granted while flying over the middle west. The clear weather extended to St. Paul where more gas and oil was taken aboard. Then followed a stretch of a hundred miles over terrain entirely covered with or only partially cleared of timber. The sun was still shining above them but a slight ground fog came into view as the aviators approached the lake region.

Within a few minutes they were flying over unbroken fog. This fog might be sufficiently high to permit them to fly above the thick woods or it might be down on the ground. The sun might break it up before they reached Superior or they might find a hole above their landing field. It is seldom the best practice under any circumstances to fly above a fog, for just at the time when an opening is needed worst, the fog has the faculty of being the thickest.

Accordingly the airmen dropped down and entered the fog. The pilot throttled his engine and flew along at the minimum speed of the plane while trying to get below the fog bank.

He hoped that the railroad which he had been following was still beneath him but railroads have many curves that come at the most unexpected times. He kept his plane on an even keel by flying with his instruments. He watched his altimeter continuously so that he could level off when about a hundred feet above the ground provided he did not come out into the clear before that. If there were no high trees or hills the plane would fly along without difficulty but if there were hills in the vicinity, there would be a bad crash.

Down they went with nothing in sight but the murky fog and the inside of the cockpits. Five hundred feet and still no clear air; four hundred, three and finally two, and at last they came out into the open. The railroad was nowhere in sight. Thick woods were everywhere and the tree tops seemed to brush against their landing gear.

There was nothing to do but try and find a railroad and follow that into Superior. The pilot knew that there were several railroads leading into the town from the south. If he could continue his flight long enough sooner or later he was sure to reach one of them.

The flight was continued under the fog, dodging high trees, swinging to the right and left to avoid hills. It seemed as if they must reach a railroad soon. Lake Superior was only fifty miles away when they had seen the first evidence of fog. They had been in the fog for about twenty minutes and were traveling at a rate of over a hundred miles an hour.

Anxious minutes followed, the airmen straining for a glimpse of the railroad, a town, a highway, anything but fog and treetops. Something must happen soon.

Suddenly a bright spot appeared ahead. It might be a clear area and then again it might be a thicker area of white fog.

They came out into the open right at the town of Superior. The sun was shining through a hole in the fog. Off to their right was the airport. Within a few minutes the plane was on the landing field in front of the hangar but, as if to show what might have happened, the fog almost immediately closed in and settled down to the ground.

There are more than four hundred patches on this plane, the result of an encounter with a hail storm. In some places the hail went through both the top and bottom wings.

Radio Requirements

Admiral William A. Moffett, chief of the Bureau of Aeronautics, United States Navy Department, has outlined seven requirements in the specifications covering future designs of radio equipment for use on aircraft. These requisites are as stringent and exacting as entrance requirements to a university or the covenant of a League of Nations. They are as follows:

(1) Maximum power per pound of weight; (2) Minimum weight for distance required; (3) Maximum dependability; (4) Maximum ruggedness; (5) Capacity for withstanding extremes of temperature; (6) Ease of maintenance; (7) Minimum cost.

Despite these exacting demands, Admiral Moffett is optimistic when he states, "During the past year, as the radio art has progressed, these requirements have been more nearly met. Each succeeding model has been greatly superior to the preceding one and has been purchased for a smaller amount of money. The decrease in unit cost has been due in part to the larger orders placed, which were necessitated by increase in the number of aircraft in operation.

"The demands of the fleet have required that equipment be developed which embodies greater distance with equal or less weight. These demands have been met from year to year. It is believed that the ultimate has not been reached with interme-

(*Continued on page* 120)

Airman, Where Do We Go From Here?

By Lt. Cdr. P. V. H. Weems, U. S. N.

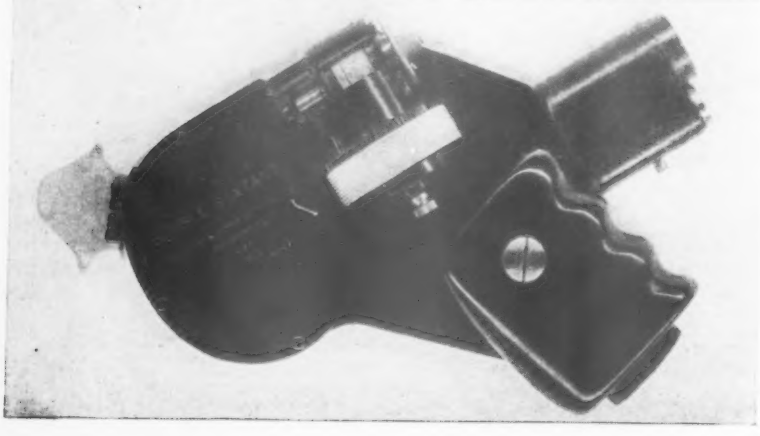
MANY laymen cannot understand the failure of so many long overseas flights. It is a difficult matter to hold reliable post mortems on just what sort of avigation is done on long flights. If the avigator is lost, little or nothing is known about what happened during the voyage. If the avigator successfully completes the voyage, he immediately becomes an authority on the subject, and in this case he would perhaps be reluctant to tell about all the foolish little mistakes he made, or all the doubts he entertained. We have, however, a few refreshing exceptions which really give us some insight into just what takes place in the avigator's cockpit on a long flight. One of these exceptions is the frank story which Lincoln Ellsworth tells about his Amundsen-Ellsworth Polar Flight of 1925. The expedition left Spitzbergen in two sea planes with sufficient fuel to reach the North Pole and return. After flying long enough to reach the vicinity of the Pole, the planes were forced to land in order to determine the true position, as it was found impossible to do this in the air with the equipment used. In landing, one plane cracked up and the six members of the party succeeded in getting back to safety in the remaining plane after twenty-five days of thrilling adventure on the ice. This expedition failed in reaching its objective on account of the inability to avigate with sufficient accuracy. After landing, it was found that the planes were fifty miles or more to the left of the proper course. The trouble lay in the fact that Riiser-Larsen could not make the bubble sextant work properly while in the air.

To go back a few years, it is clear that the avigator of the Zeppelin which flew from Germany to Africa and returned "knew his avigation," though we have little information as to the details of the work done in this flight. It may safely be assumed that the German Government had full assurance that the craft could be efficiently avigated before it was permitted to leave Germany. It might be stated, however, that the avigation of lighter-than-air craft is a much easier matter than that of heavier-than-air craft.

An interesting and impressive example of real avigation, perhaps the best on record, was that done by Admiral Coutinho of the Portuguese Navy, when he flew eleven hundred miles across the Atlantic and picked up St. Paul's rock off the Brazilian coast. The Admiral states, and we have evidence to support the statement, that he knew his position within five miles throughout the entire flight. Practical avigators who have tried to attain extreme accuracy with the bubble sextant will question the accuracy claimed till they understand that the bubble was not used at all. The plane flew near the surface of the water, and Admiral Coutinho, an experienced navigator, simply applied sea methods to the air and used the natural horizon instead of the bubble. He was prepared to use the bubble if needed, but he found it possible to use the natural horizon throughout the flight. Had he been forced to use the bubble his average errors would probably have been from five to twenty miles—at least that is about as well as we are able to do in this country. In smooth air we can get within five miles, while in bumpy air errors of twenty or more miles may be expected. This spectacular flight makes a strong case for the use of the natural horizon when it can be seen.

Hegenberger carefully planned his work—and then worked his plan—on his splendid flight to Honolulu. He used both celestial avigation and the specially constructed radio beacon. Over the same course Lt. Davis avigated both by the radio beacon and celestial avigation, using a bubble sextant. The results, he claims, checked within twenty miles of the true positions.

One has the greatest admiration for the avigation feat performed by Schluter, the sea-going navigator of the number two plane in the Dole Flight. With Schluter, it was apparently a case of antiquated methods thoroughly understood and made to work under extreme difficulties. It is said that he was forced to sit on his knees in a cramped position, that in making his long computations he figured all over the bulkheads, tanks and everything else that would serve as a blackboard. Also it is stated that he required Jensen to circle in one spot for some time in order to wait for the sun to get on the meridian so he could take a meridian altitude. Finally, getting the alti-



Modified Bureau of Standards design of bubble sextant. It is light, compact, simple in construction, and may be operated with one hand.

tude, which plotted north of the islands, the flyers headed south and landed with only twenty minutes of gas left.

It is a sad fact that some of the Dole Flight contestants may have lost their way due to faulty avigation, missed the islands entirely and then flown on and on into the Western Pacific till their gas supply failed, and the plane finally was swallowed up by the sea. At least we know this; all of the planes to reach Honolulu were directed by skilled avigators. It is true that some of the planes lost had qualified avigators. Therefore, it is impossible to state definitely who were lost by engine failure and who were lost by faulty avigation.

It is next to suicide to take off on a flight like the Dole Flight without the proper equipment and without the ability to avigate safely and surely. On a flight like Colonel Lindbergh's epochal voyage, where a good compass course will bring the plane to its destination with sufficient accuracy, celestial avigation is not of so much importance. Even on this flight, according to Colonel Lindbergh's expressed opinion, had he been able to determine his position by means of celestial avigation, he would not have been forced to descend through the clouds and fogs and fly near the surface of the water. He left a tail wind above the clouds, but he had no means of avoiding this as he was not equipped with a bubble sextant and watches. Later when he planned another trans-Atlantic flight he took up the study of celestial avigation and it was the pleasure of this writer to instruct the Colonel in this subject. Colonel Lindbergh then stated: "I consider celestial avigation necessary to future avigation."

If Commander Byrd were lost on a flight, few would believe he lost his way. As a matter of fact, it would most certainly be due to some failure of his plane, since it is known that Byrd is an experienced, careful and practical avigator.

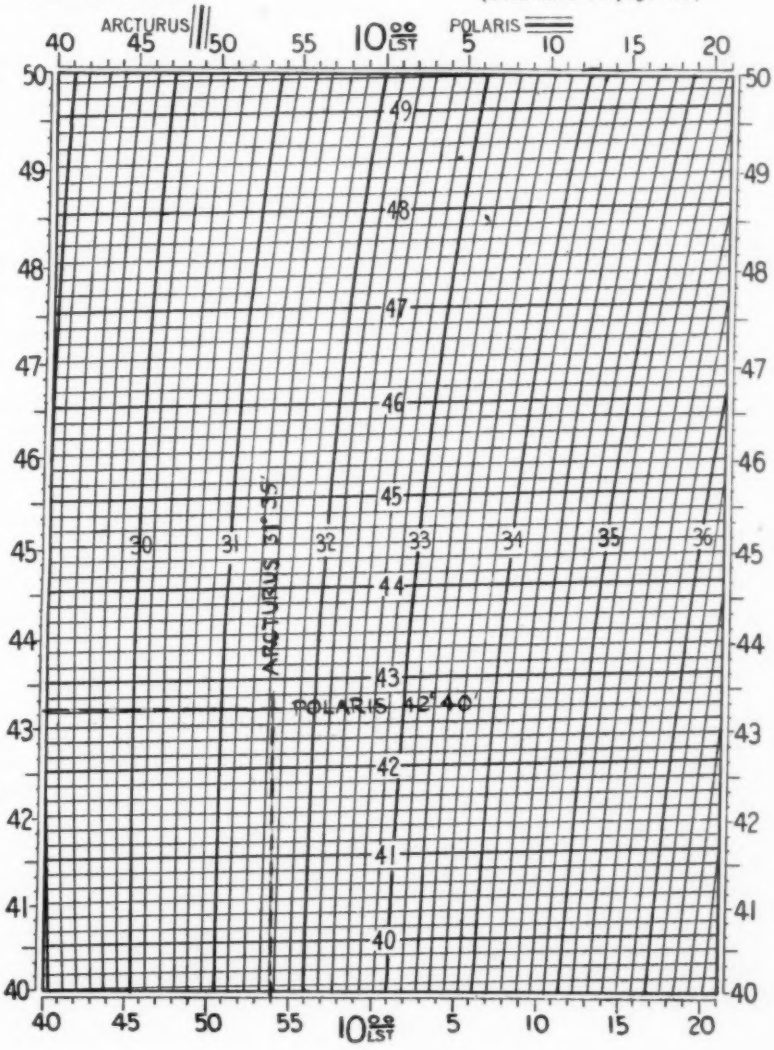
If we are to believe newspaper reports—not having other information—the Bremen, carrying the German-Irish flyers, was lost before it landed although stars were visible overhead. With stars visible, and with the proper equipment, we have the very best conditions for the efficient avigation of aircraft. Due to the high speed, frequent positions are necessary, and frequent positions may be found readily by means of star observations with a good bubble sextant, combined with the use of aero-chronometers and "Star Altitude Curves." It should be a simple matter under ordinary conditions on these long-distance night flights to obtain, every few minutes or less, positions within ten or fifteen miles of the true position.

If we are to carry out the spirit of Commander Byrd's recent article in the Saturday Evening Post, "Don't Let Them Die," we shall see that those who go down to the sea in planes as well as those who go down to the sea in ships, are properly equipped and trained to know their positions. It is a pitiful thing for a person who does not know what a chronometer is, and who does not know how to adjust a sextant, to risk everything on his ability to avigate a plane for hundreds of miles across the sea. On the other hand it is encouraging to know that with equipment now available a person with a few weeks training may take a sextant, a pair of watches (aero-chronometers) and a couple of small books, and with this short training and comparatively simple (if somewhat expensive) equipment, and with celestial bodies visible, avigate a plane anywhere, at any time.

By employing this system, the flyer is able to secure his position, in less than a minute, with a very high degree of accuracy. Readers of Popular Aviation will be interested to work out the fix illustrated on the accompanying chart. The chart itself is a page from Weems' Star Altitude Curves.

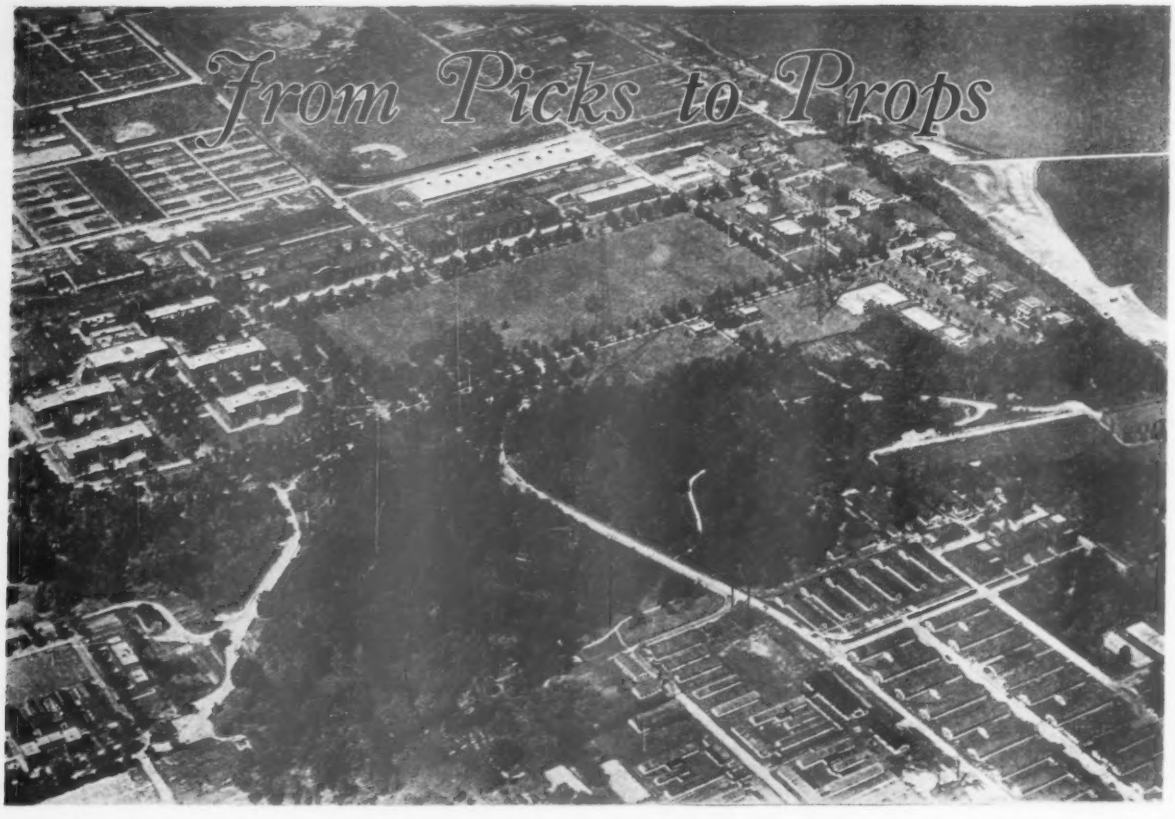
The principles underlying the Star Altitude method of avigation are described in introductions to the Curves. Unlike other heavenly bodies, "fixed" stars remain practically stationary in the celestial sphere. From

(*Continued on page* 112)



Typical page from Star Altitude Curves, showing fix for position obtained on Polaris and Arcturus, as described by Commander Weems.

From Picks to Props



Great Lakes Naval Training Station from the air.

By Ensign Bilge
Naval Reserve Air Training
Part 2

"RISE and shine!! Pile out!! Hit the deck you sailors!!" Thus began the second morning of a training life lasting forty-five days, for which the word strenuous was a mild descriptive.

The only thing of particular interest to Goofy and me after our labors of the day before behind a pick and shovel in an unsuccessful attempt to locate the buried water main behind No. 1 hangar, was the morning flight list. We occupied only half the allotted time in which to secure our bunks and make our lockers shipshape, but there were eighteen other students with the same thought and due largely to Goofy's lack of size and my big feet we were the last ones to arrive at the bulletin board. It was only with a brilliant display of football tactics that we were able to force our way through the group of students in a huddle around the board.

"Cut out the shoving!" growled one student. "Do you want to get knocked for a tail spin?"

By this time we were in the front line and before us was the pleasant news. Picks yesterday, props today. Goofy was scheduled for the first hop in No. 2 and I was scheduled for the second hop. Monkey drill was a pleasure that morning and so intense was my excitement that I neglected to eat the greater part of my breakfast. The planes looked bigger that morning and their motors sounded more powerful as they were being warmed up. Were they never going to take off?

"Hurry back, Goofy," I shouted as the plane slid down the runway into the water.

"Like Hell I will," he replied, thumbing his nose at me. An officer called me to where he stood.

"Are you next on the flight list?" he said.

"Yes, sir," I replied.

"Well," he continued, "I suggest that you climb into the plane in the hangar (it is being overhauled) and familiarize yourself with the controls as much as possible. There is a great deal that can be learned by just sitting in the plane and going through the motions of flying, doing 'beach flying.' But be ready to go as soon as the plane comes back."

"Aye, aye, sir," I saluted and nearly fell down attempting to do an about face. As I looked back over my shoulder the officer was trying to conceal a smile.

The next thirty minutes seemed an interminable time and I was back on the beach to watch No. 2 come gracefully in to a "heel down" landing. Goofy grinning from ear to ear climbed out; I climbed in.

"Now," said my instructor, "I will take off and fly around for a few minutes and then land. Do not touch the controls; just keep your eyes open."

He taxied out to open water and headed into the wind. The motor was opened full out. I tried to watch the controls and instruments, I tried to watch the water, I tried to watch the wings, but everything resolved itself into one confused mass of moving controls, meaningless instruments, wingtips, spray, and deafening noise.

My first thought after the take-off had been accomplished was, "It is not as easy as it looks. I wonder if I will ever be able to learn to use all those things." We flew around for a few minutes and I had my first view of the Naval Station from the air. The instructor then began his

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approach for a landing. The art of landing seemed easy as compared with the take-off. As the pontoon ticked along the tops of the waves it created the sensation of a balloon tire on an automobile, going flat. It had the same bumping feeling. If the flat tire occurs on one's own car it is usually accompanied by a feeling of mingled anger and disgust. Anger and disgust can be disregarded at this stage of instruction; there will be plenty of use for them when I begin to make landings of my own.

"This time," said the instructor, "when I shake the controls, that will be the signal for you to take them. Your job is to keep the wings level and keep the nose on the horizon." ("This is going to be easy," I thought.) "When I shake the controls and pat the back of my head with my hand you release them immediately. Try to fly in a straight line, and *do not freeze on the controls.*"

"Aye, aye, sir," I replied.

Another complicated take-off—the controls shake—my chance at last. —It is not so easy after all. The horizon seems to bob around in a most unwarranted fashion, the left wing goes down, then the right one —a blast of wind against my right cheek—what caused that? The horizon is creeping under me—the air speed meter registers only forty-five knots. The controls shake, I release them, and strange to say the horizon seems suddenly tamed, and we are again flying on an even keel. The motor is cut.

"You are over-controlling," the instructor shouted, "take it easy."

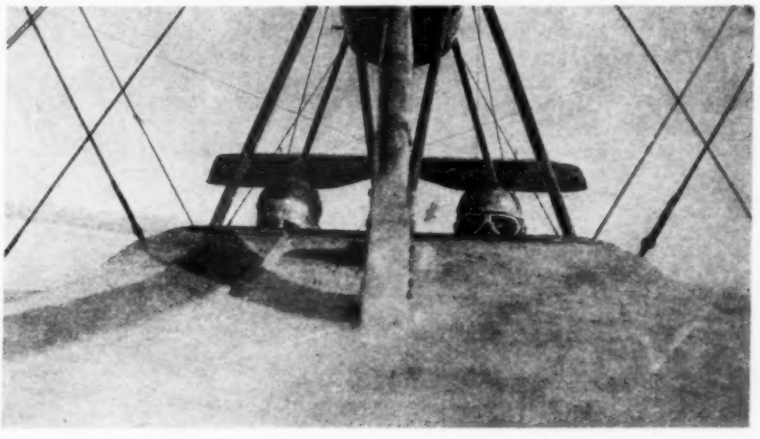
I tried again and found that by making small adjustments to the controls I was able to keep the plane on a fairly even keel. My thirty minutes of instruction were over too soon. We landed and I climbed out to make room for the next victim.

"The next time we will practice making shallow turns," said my instructor. "Who is the next on the list?"

"I am, sir," anxiously replied a waiting student.

The days went rapidly by and flying time piled up slowly. New students were coming in to fill the vacancies created by those who were constantly being weeded out. To add to our troubles sand kept washing in and obstructing the end of our one and only runway so that it was sometimes impossible to get the planes into the water. It was not a simple task to remove this sand, as it had to be done under water with shovels. One student rigged a diving outfit out of an old bucket and a bicycle pump. The oxygen supply was furnished to him by means of a long flexible rubber hose attached to the pump and leading to the inverted bucket which served as a helmet.

Each morning on waking my first move was to glance out the port hole over my bunk to take inventory of the weather. Early morning fogs would often come in heavy blankets and could be seen literally rolling up the cliff behind the hangars, sometimes forcing us to suspend operations until noon. We were by no means idle while waiting for the elements to favor us. There was still that water line to be located and repaired. There was always repair work to be done on the planes, and there was our ground school work in which we were far in arrears.



Looking back at the crew of the HS-2L in flight.

My flying instruction continued slowly. I practiced 15 degree turns and as my proficiency increased, the angle of bank of the turns likewise increased until I could do flipper turns (the angle of bank greater than 45 degrees). I practiced landings and take-offs.

"This time," said my instructor, "keep the nose headed into the wind. Every time you take-off you get worse. And when she gets up on the step don't try to pull her off, just let her fly herself off. If you cannot do what I tell you I will put you on the beach for a couple of days to think it over. Let's go."

There is nothing a student dreads more than being "beached" or taken off the flight list.

I gritted my teech, gave her the "soup," pulled the wheel back to my chest and waited for the plane to pick up speed, constantly checking her direction with the rudder. As she gained speed and began to try to lurch out of the water I pushed the controls to the dash, and she climbed up onto her step and began to hydroplane. As the speed continued to increase I gradually took up the "slack in the controls" until the plane took off. The instructor clapped his hands above his head, meaning "well done."

We climbed to 300 feet and he gave the signal for a landing. I nosed her over and began a cautious glide to the water. I leveled out; everything looked splendid; but as the plane touched the water it porpoised off the first wave, settled, porpoised again, and finally did it yet again. We had made one of those perfect three in one landings better known as a pay hop. We finally came to rest and the instructor turned around with a disgusted look on his face. Some of the things he said are not fit to print.

"That's too hot!" he shouted. "How many times must I tell you to level her out at three feet and hold her there until she stalls on by herself? Keep the tail down and land on the heel of the pontoon. You gotta land them slow or they will porpoise every time. Try it again."

After seven hours and thirty minutes of instruction my landings had become fairly consistent; the day of the big adventure had arrived. It was late in the afternoon when my instructor approached me as I was pouring gas into a plane.

"As soon as that plane is ready, take the cushion out of the front cockpit and fasten the safety belt." Then without warning, he said, "Take it out for fifteen minutes solo, and do not forget to come back."

A feeling of mingled joy and fear shot through my body. At last I was to fly alone, the first student in the class to solo. Trembling with excitement I taxied away from the

beach and headed into the wind. There were no reassuring head and shoulders in the cockpit in front of me. I had never before noticed that it was so far between me and the motor—but it was mine now and no one to bawl me out if I skidded a little on a turn or made a rotten landing. I was king. I knew all eyes were watching me. I gave her the gun. The take-off was a beautiful one and she climbed rapidly without the "extra passenger." I breathed a sigh of relief.

"Now," I thought to myself, "if I can only set her down as prettily as I took off, everything will be jake."

I circled and spiraled. The supreme superiority of being alone overwhelmed me. My classmates must surely envy me, and won't the "pater" be proud when I write and tell him about it? Fifteen minutes passed, then twenty, and twenty-five, —all too quickly. I cut the gun and started my approach, leveled out three feet above the water and held her there until she settled gently on and stayed. A beautiful landing—what luck—another sigh. When I climbed out on the beach my classmates gathered around to congratulate me.

"How was it?" they asked, "were you scared?"

My instructor approached and I expected congratulations.

"You are beached for one day," he said. "I told you to stay 15 minutes and you stayed 30."

The next day, knowing that I was not on the flight list, I shadowed my instructor in the hope that he would change his mind and let me solo again.

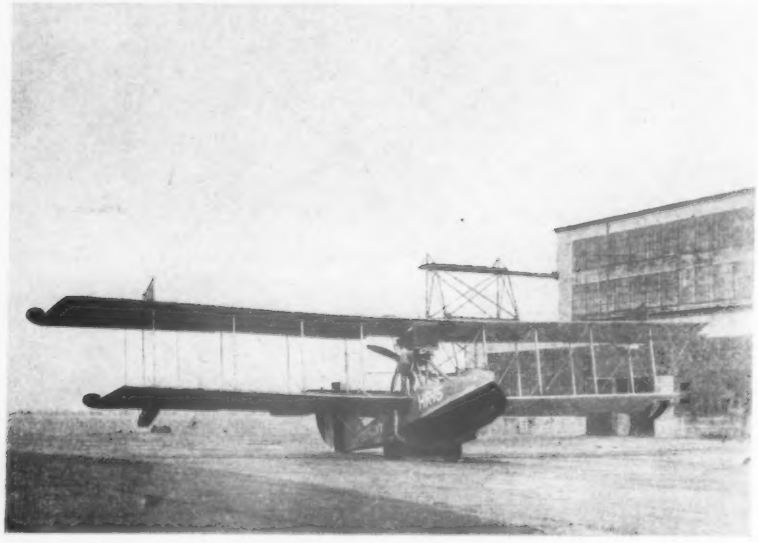
"Want a hop?" he said to me.

"Yes, sir, very much," I replied.

"All right, hop on this shovel," he said laughingly, "and see if you can locate that water main."

Back to picks again. My heart sank. Why should an aviator have to dig ditches?

As the days went by I continued to add a few minutes to my log book at every opportunity. Anxious to get my required thirty hours of solo I would request the use of a plane during meal hours and would often have to fuel it entirely alone. I passed my five hour check and then my ten hour check. The syllabus called for practice in acrobatics and emergency landings after ten hours of solo. Being far ahead of the rest of my class, and having overheard my instructor say that I was a good flyer, I began to believe it myself.



On the apron.

Trouble began. An aviator who allows himself to believe that he is exceptional is flying without a safety pilot.

Late one afternoon I was practicing emergency landings by flying down wind at five hundred feet, cutting the gun and then making a one and one-half spiral in order to land into the wind. My safety pilot had relinquished the reign to old man "over-confidence."

I cut the gun and banked over steeply but neglected to kick enough rudder. Flying speed was lost and the plane stalled and fell into a spin. When terra firma or Lake Michigan begins to rapidly increase its proportions directly ahead of you it is time to act and act quickly. Ahead of me was a whirling mass of water rapidly advancing to meet me. There was no sensation of fright although I was certain I was going "on in." Instantly I remembered the axiom,

"When in danger or in doubt,

Nose her down and kick her out."

The wheel went forward to the dash, the rudder bar into the corner. The lake ceased its spinning but by this time was nearly upon me; I pulled back on the wheel, but too late; I had run out of altitude. The plane struck head on at an angle of about forty-five degrees—the belt jerked about my waist, my head went forward against the cowling—there was a huge splash, a sickening, rending, crushing, tearing noise—like a tree in the forest, struck by lightning and falling to crush its mates. Then a hissing gurgling sound as the hot motor began to immerse itself further into the water. Stunned only momentarily, I jerked loose the safety belt—the plane was sinking and I must get free of the wreckage. But it did not sink. I surveyed the damage—a complete wreck. My career as an aviator was at an end—my castles were tangled ruins—surely I would be booted and probably court-martialed. Nothing to do but wait for the crash boat. Would it never come? Was the plane settling? A further inspection revealed that one air compartment in the pontoon was still intact and the plane would float for some time yet.

The speed boat arrived with my instructor in the bow.

"Are you hurt?" he called, as the boat came alongside.

"Hell, no," I replied, pointing to the mass of wreckage, "but look at this damn airplane." Tears of disappointment were streaming down my cheeks to mingle with the blood coming from a few cuts.

I was taken aboard and rushed to the hospital where two surgeons discovered that my anatomy was still intact. I was slated to remain in the hospital for one week as it was feared that I might be injured internally. During the second day of confinement a boy was brought in to occupy the bed next to mine. He had fallen out of his hammock, resulting in the fracture of his collar bone, and a badly wrenched back. Turning to me he said:

"How come you fell 500 feet and did not get a scratch, and I fell 6 feet out of a hammock and get mutilated?"

"It is an art, my boy," I replied. "It is an art."

I returned to duty a week later to find that the cook had quit the Navy to go into the chicken roost business.

Not being satisfied with leaving us to our own poor resources in regard to cooking, he had persuaded the chief instructor to go into partnership with him. The most extraordinary part of the whole thing was that the patent chicken roost netted them several thousands of dollars apiece. They even invested in a Waco for use as a liaison unit between their factories.

Goofy, having taxied a plane into a pier, doing considerable damage, was beached for two days and placed on K. P. duty. It was during these two days that we discovered much to our dismay that the cucumbers had acquired a growth of hair. After due investigation it was found that Goofy had used the cucumber bowl for a shaving mug and neglected his dish washing to a certain extent. With two additional days on K. P. duty his ability to wash dishes was much improved.

Our 45 day training period was rapidly nearing its completion and none of us had had more than half of the required thirty hours of solo. It seemed almost certain that our advanced training would be deferred until the following summer. We were a discouraged group of students who were called into the executive office. We had worked hard, and practically without exception, willingly. Ditch digging, mess duty, watches, and the many other disagreeable jobs were done with a spirit of willingness, for we were looking always forward to our advanced training and finally to our commissions, the goal of every service student aviator. Discipline in the strict sense of the word was a thing unknown. When there was work to be done it was not necessary to order us to do it; we were living up to our end of the "gentlemen's agreement." Our morale was low because it was apparent that we were to be released from active duty until the following summer. We stood grouped before our commanding officer, Lt. Comdr. H. W. Scofield. It was not from discipline but rather from respect that we stood at attention as he spoke.

"It has been a pleasure to me to have a group of men, such as you have proved yourselves to be, under my command. Your 45 day training period is at its end and unfortunately none of you have the required number of hours. The class at Hampton Roads, Va., does not begin for two weeks. Are there any of you who are willing to stay, without pay, for an additional two weeks in order to qualify for your advanced training?"

Without exception we agreed.

"Good," he replied. "It will be impossible to qualify all of you so our efforts will be concentrated on those who have the most flying time and the best marks. In the meantime no stones will be left unturned to persuade the Bureau to grant pay for the additional duty."

The following two weeks were a bedlam of activity. Piling up time was the objective and one student put in as much as six and one-half hours in the air in one day. When weather was bad and the danger great from the possibility of a forced landing in rough water, we resorted to the use of safety pilots. This was done not alone for the safety of the student but for protection of equipment. A damaged pontoon meant the loss of several hours of flying time. A crash meant that only about half of us would get to qualify.

One student named Brossman had exceptional difficulty in making landings. He had a method all his own which no one else had any desire to copy. From the time he began to solo and make "pay hops," all poor landings were dubbed "Brossmans." As the maneuver of rolling at the top of a loop was named after its originator, Immelman, so was a bad landing given the name "Brossman." He always maintained that any landing that you could walk away from was a good one. In the same manner a

(*Continued on page* 110)

A landing that turned out to be all wet.

Down and out.

Civil Aviation in Canada

By E. L. Chicanot

THERE has unquestionably never been the interest in the varying phases of aviation in Canada such as is evinced at the present time. The year 1927 served to draw the Dominion in a most demonstrative manner out of what appeared to be almost a lethargy in this connection to a popular state of mind where aviation in all its branches is very much to the forefront. To peak the rising interest of the year came developments which heralded the dawn of civil aviation in Canada and this branch of areonautics is getting away to a most auspicious start this fall and elaborate developments are forecast for the future.

Evidence of the alertness of the general public throughout 1927 became increasingly apparent. The Dominion was enthusiastically receptive to the idea of locating a mooring mast for trans-Atlantic airships on her domain and there was keen rivalry between Eastern Canadian centers for the securing of this honor. When Montreal was selected for the terminus the site was rapidly determined upon and the purchase made so that commencement was immediate upon erection which is steadily progressing. Initial experiments in the aerial transport of mail, which came as a good deal of a surprise to the general public, were watched with closest interest, and today projected extensions to those services established last year, including the linking of Montreal and New York, are being closely followed and the ultimate bridging of the Atlantic and Pacific through links connecting up the larger Canadian centers eagerly anticipated.

A greater confidence, reflected in greater patronage, resulted in a considerable elaboration of the Dominion's yet meager commercial services in the past year. Organizations operating A1 aircraft in the Dominion numbered 21 in 1927 whereas there were only 16 in 1926 and 10 in 1925. These accounted for 12,070 flying hours in 1927 as against 5,860 hours in the previous year and 4,091 in 1925. In the two year period the number of passengers carried increased from 4,987 to 16,677, the increase in the past year alone amounting to more than 162 per cent. Freight carried almost doubled in the two years, rising from 592,220 pounds to 1,098,346 pounds, while the increase in mail transportation was even greater, from 1,080 pounds to 14,686 pounds. Altogether the year 1927 was a momentous and significant one in creating a new public attitude towards air affairs.

It came as a good deal of a surprise towards the end of 1927 to discover that the powers-to-be had not been altogether asleep and that throughout the post-war period when so little was apparently being done for civil aviation they had been keenly observant of developments elsewhere and were studying them closely with a view of ultimately turning the experiences of other countries to Canadian benefit. It would seem to be fairly clear now that the authorities were preparing a good groundwork upon which real constructive building might be done when it was decided the time was propitious. With the aerial mail successfully launched the decision was apparently reached that the time was ripe and the Government prepared to undertake to develop greater air-mindedness in the Canadian people for the great era of aviation which it is the general conviction awaits in the immediate future for the Dominion.

The war years, of course, primarily laid a splendid basis for this. Canada, for the size of her population, must have had more trained flying men than any other nation of the allied armies, for pilots from the Dominion constituted a very large percentage of the personnel of

the Imperial flying forces. It goes without saying that a very large number of these men returned to Canada and resumed peace-time jobs on the ground with the greatest reluctance after the termination of hostilities. A proportion got into the flying services of the various Governments, but these bodies were flooded with many more applications than they were able to accept or find places for. Not a few in desperation returned to England to endeavor to get back into the Imperial flying services, while the varied services of the United States absorbed others. Some valiant and intrepid spirits, in the face of innumerable difficulties, launched Canada's first commercial flying services and have pioneered this phase of aviation in the Dominion, for which they have so far received scant reward.

Circumstances, however, compelled the majority to keep their feet upon the ground and endeavor to forget they had ever flown and stifle the memory of that zest and exhilaration which nothing else could impart. The situation was peculiarly difficult for such men in Canada in the paucity of Government and other services. Practically none were in positions to purchase machines of their own, which had to be imported either from England or the United States. So hundreds of young men, whose courage and prowess in the air had been proved under the most exacting of circumstances, placidly took up and pursued ground jobs, but though apparently they had turned their backs definitely upon the hectic war days the lure never left them and they were ready to flock back in numbers when the occasion offered.

The clearest proof of this was given when on the visit of Dr. Hayden Guest from England, on behalf of the British Air League, they were invited to form a Canadian branch of the league. Ex-pilots and would-be pilots flocked to meetings in Montreal, Toronto, Winnipeg, Vancouver and other centers and formed branches. Later they were all amalgamated at a meeting in Ottawa attended by delegates from all over Canada including representatives of McGill and Toronto Universities, of commercial aircraft manufacturing companies, and some of the Dominion's most famous airmen. The Aviation League of Canada was definitely established bringing all interests into one body for the promotion of aviation in all its branches in the Dominion. Although so recently come into existence the League is a real and vital body and backed by enthusiastic and expert support seems destined to be an important factor in the promotion of civil aviation in all of its phases. With a general headquarters at Ottawa there is an active branch operating in each of the provinces.

Briefly, the League will assist commercial aviation in Canada in every possible way. Promoting research, experiment and manufacture; attempting to interest universities in the establishment of chairs of aeronautics, and colleges and schools in the instruction of aviation principles and ideas; as well as lending assistance in the organization of a Canadian Air Force to meet any emergency. Generally, the League will endeavor to create a public air-mindedness and influence young Canadians to take up aviation. It will foster the formation of flying clubs so that young men may be taught to fly and older pilots may refresh their memories and impart their knowledge to the country's youth. It will interest itself in the establishment of schools of flying and instruction and establish a bureau of aviation where information on aeronautics will be available to those interested in the formation of companies.

Considering its population there is probably more interest in aviation in Canada than in any other country. The government has embarked on a program of help to the Canadian Aero Clubs which is the envy of all other countries.

The Canadian Air League was but in process of formation at some 27 points from coast to coast in Canada by groups of experienced and enthusiastic young men eager to lend their endeavor to the stimulation of civil aerial development among the people of Canada, when out of a clear sky came the announcement of a Government policy for the encouragement of civil aviation by providing facilities for the training of young Canadian fliers through the formation of light aeroplane clubs. This assistance, offered through the Department of National Defense, aims at the establishment of such clubs in the larger centers of the Dominion to promote a more widespread knowledge of aviation. The general scheme of the Government is to issue to each approved and duly incorporated club or association two light aeroplanes free of charge, on condition that the club furnish a suitable field or seaplane station for their operation, and make provision for the services of a duly qualified instructor to supervise the flying and a licensed air engineer for the maintenance of the aircraft in airworthy condition.

An order was immediately placed by the Dominion Government for over $400,000 worth of new areoplanes for the purpose and the necessary equipment. Included are 3 Fairchild monoplanes, 2 de Havilland planes, 6 Avro aircraft, and some other types, in all amounting to 26 new air machines. The term of any agreement entered into under the scheme is for not more than five years from April 1st, 1928, and should the demand for flying instruction exceed the capacity of the two aircraft so issued the Department may issue in each year after the first one further light aeroplane, provided that the association or club has from its own resources supplied a similar aircraft of approved type.

According to all indications the Government's initial provisions are going to prove hopelessly inadequate, and demands for planes already greatly exceed the number made available, so that it is understood a supplementary order has been placed by the authorities. The response throughout Canada to the Government's offer was spontaneous, general, and wildly enthusiastic, there being scarcely a center of any population where eager young ex-pilots or would-be flyers did not immediately meet together to band themselves in such a club. There were 700 applications at Montreal. Several hundred young men at Toronto formed such an association and the Flights of Western Canada at Winnipeg consists of three hundred members. Many of the other clubs have more than one hundred practical or aspiring pilots. Women are eligible as well as men and the number of the gentler sex to enroll at the various centers has been remarkable.

Some twenty clubs, among them Montreal, Toronto, Ottawa, Quebec, St. Catherines, Hamilton, Calgary, Winnipeg, Edmonton, Vancouver, and Victoria have reached a point in organization and progress where planes are being despatched to them and flying is on the verge of great activities. Limitation to this number has only been fixed by the availability of planes at the outset. All

(*Continued on page* 110)

The Danger of Take-Off With Heavy Loads

By Elliott G. Reid and Thomas Carroll

National Advisory Committee for Aeronautics, Langley Memorial Aeronautical Laboratory.

A SUCCESSFUL take-off can be made with an airplane so heavily loaded that it cannot climb to a height greater than the span of its wings.

The explanation is that the power required to maintain level flight at an altitude equivalent to the wing span may be as much as 50 per cent greater than that necessary when the airplane is just clear of the ground.

The failure of heavily loaded airplanes to continue climbing at the rate attained immediately after the actual take-off is a grave hazard and has resulted in great risk or catastrophe in three notable cases which are cited.

Three years ago the writers instituted and carried out an investigation of ground effect. The results of this work have been published in the National Advisory Committee for Aeronautics' Technical Report No. 265, "A Full Scale Investigation of Ground Effect." In this report it was pointed out that the climbing ability of an airplane is favorably affected by proximity to the ground and particularly so in the case of a heavily loaded one. One of the most important conclusions to be drawn from this work is that an airplane can be taken off with a load greater than that which can be successfully carried across country.

At this time when so much interest is centered upon flights of long duration, transoceanic and otherwise, which are almost invariably attempted upon an airplane loaded practically to its capacity for getting off, the importance of this phase of ground effect should not be underestimated, because it must be borne in mind that after the airplane is free of the ground it must climb to a sufficient altitude to avoid obstacles of artificial or natural origin which may lie in its path and that often a change of direction is necessary shortly after the take-off.

Three cases in which the occurrence of this phenomenon has undoubtedly caused the endangering or loss of the lives of thoroughly capable pilots are of record:

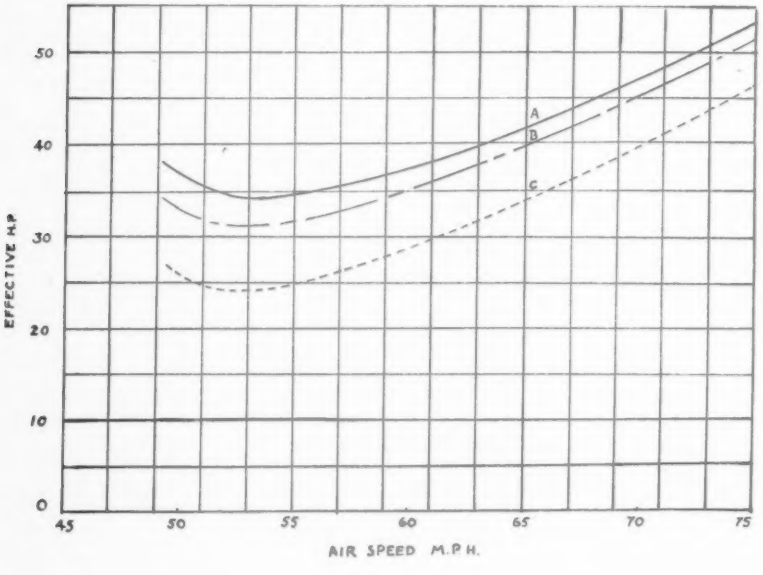
1. Some time ago a very heavily loaded seaplane, which at that time was under test at our laboratory at Langley Field, was successfully taken off but could not be forced above an altitude of about 50 feet where level flight was maintained for approximately ten miles. A landing became obligatory at this point because the pilot considered it dangerous to make a turn under these conditions. Fortunately, this was successfully accomplished and a portion of the load was removed in order that the return flight might be made.

2. The "American Legion," transoceanic airplane, piloted by the late Commander Davis and Lieutenant Wooster, taking off from Langley Field under full load conditions, left the ground after a run which was even somewhat shorter than had been expected, climbed with relative rapidity to an altitude of possibly 30 to 50 feet, and continued in the direction in which it had taken off until it was necessary to either rise or turn to avoid high trees. It is evident that the pilot chose the turn, whether or not he found it impossible to rise, making the turn with only semi-success, since it was accompanied by a disastrous loss of altitude.

3. According to press dispatches, Captain D'Oisy and M. Gonin left Le Bourget Field, France, for an objective in India but were unable to attain an altitude greater than 30 to 60 feet (conflicting reports) and were forced to land after having flown approximately 2½ miles. Fortunately, both men escaped from the plane, which was, however, entirely demolished as a result.

Some intimate knowledge of the method of testing used by Commander Davis in preparation for his projected flight is at hand as are some less intimate but authentic data concerning Colonel Lindbergh's preparations. In both cases the tests were directed almost entirely toward determination of the take-off char-

Fig. 1.—Curve A shows the horsepower needed to maintain level flight at an altitude of 500 feet, curve B at 15 feet, and curve C at 7 feet.



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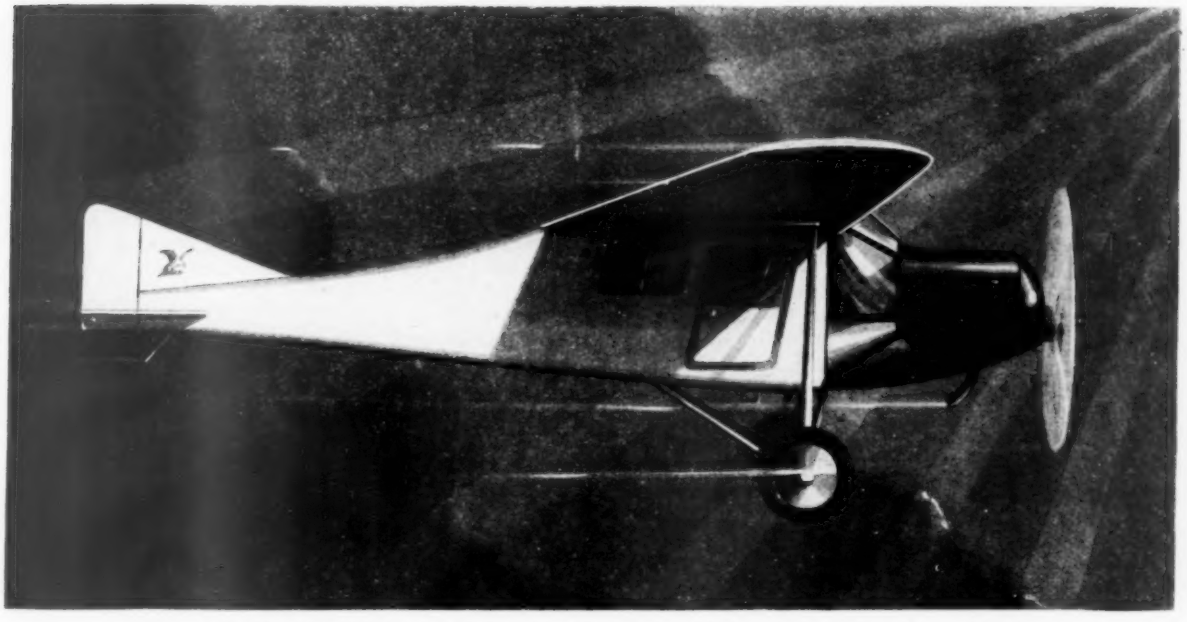

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acteristics under full load conditions. Particular attention was given to the length of ground run and the take-off speed, while less consideration was given to the more important factors, the rate of climb and the possibility of its continuation beyond the first few feet.

To explain the dilemma in which the pilot of a heavily loaded airplane may find himself immediately after take-off, it will probably be best to extract some information from the above-mentioned report on ground effect. Figure 1 illustrates the reduction of the power required for level flight as a conventional biplane (VE-7) approaches the ground. (The upper curve was obtained experimentally and the values for the lower one were calculated and confirmed by flight test; the middle curve was calculated in accordance with the method used for the lower one.) It will be seen that at an altitude of 500 feet level flight may be maintained at the expense of approximately 33.5 horsepower. It is apparent, however that when the airplane descends until its lower wing is approximately 7 feet above the ground only 23.5 horsepower are required to maintain level flight. A point of paramount interest will be noted in the minimum value of the power curve for an altitude of 15 feet. *It will be seen at once that the greatest part of the reduction of power caused by ground effect takes place within a height equal to about ½ the span of the airplane.* (Span of VE-7, 34.4 feet.)

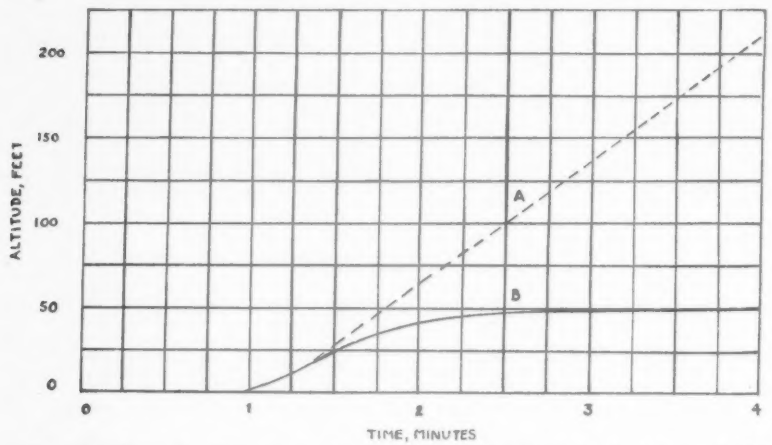


Fig. 2.—Line A illustrates the rate of climb that might be expected on the basis of initial performance; line B shows what actually takes place.

The condition illustrated by these curves is characteristic of any conventional airplane. The reduction of the required power will be of approximately the same proportion for any normal airplane flying at comparable heights, the unit of comparison being taken as the span of the wings.

The operation of this phenomenon is best brought out by considering the conditions existing during the initial stages of the flight of the heavily loaded airplane. Let us suppose that such an airplane has gained flying speed and is at the point of leaving the ground. With the engine at full throttle the pilot finds that he gains altitude as rapidly as he would expect under the existing conditions. However, having reached a height approximately equal to the semi-span of the airplane, he notices that the rate of climb has decreased alarmingly. Slight changes of the attitude of the airplane are found to be of no avail. In the interim it is probable that he has passed the boundaries of the good landing surface of the airport and may then be confronted with the necessity of gaining still more altitude in order to avoid some obstacle. Finding this impossible, he can only choose between collision with the obstacle and the doubtful alternative of attempting a turn. In either case a serious accident is probable if not inevitable.

Figure 2 is an illustration of a hypothetical case. It will be seen that the airplane begins to climb at a reasonable initial rate. The dashed curve shows what the pilot might expect of the airplane if the effect of ground interference caused only a negligible reduction of the excess power available for climbing, as is the case with normal loads. In this case, however, the excess power is a small portion of the total power available and is quickly absorbed in overcoming the added resistance which accompanies the gain of altitude. This results in fixing the absolute ceiling of the airplane at a very small distance above the ground. The solid curve then indicates the actual performance of the airplane. This figure is added to bring out the nature of the danger in more graphic form.

To avoid getting into this dangerous condition when an airplane is taking off with an unusually heavy load, a careful study of the rates of climb with smaller loads should be made. It is to be expected that the curve of rate of climb vs. load will reach a zero rate for a load considerably smaller than that which can be taken off at attainable speeds and within lengths of ground run possible on existing airports.

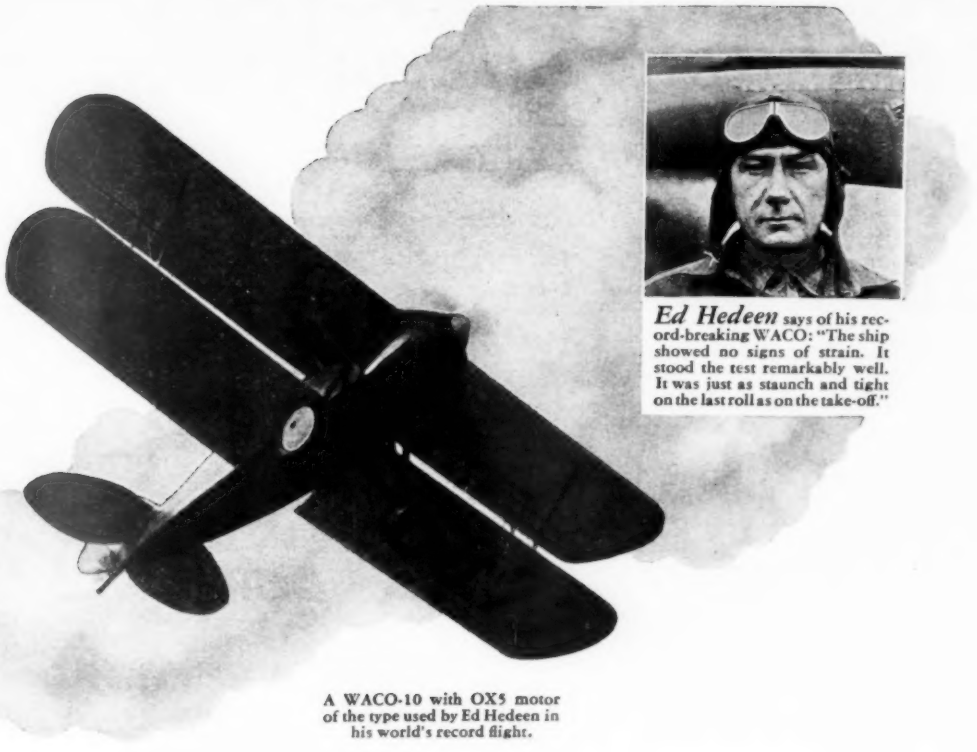
M. I. T. Laboratory

PIONEER in aeronautical education in the United States, the Massachusetts Institute of Technology recently dedicated its new Guggenheim Aeronautical Laboratory, one of the largest and most complete laboratories in the world for instruction and research in aeronautical engineering. The building, which houses class rooms, laboratories, two wind tunnels and a meteorological laboratory, is four stories high, 150 feet long by 60 feet deep and was made possible largely by the gift of $230,000 from the Daniel Guggenheim Foundation for the Promotion of Aeronautics, of which Harry M. Guggenheim is president.

The late Professor Gaetano Lanza, for many years head of the department of mechanical engineering at Tech, first became interested in the subject of aeronautics more than thirty years ago, when flying was hardly more than speculation. About 1909 he built at the institute what was the first wind tunnel in the United States, consisting of a ventilating duct about three feet square and twenty feet long, through which air was forced by means of a 9-horse power motor. The maximum speed attainable was twenty miles per hour.

In 1914-15 a graduate course in aeronautical engineering was established at the institute, under Lieut., later Comdr. Hunsaker, who was detailed by the U. S. Navy Department to act as instructor, the course leading to the degree, Master of Science. Among his early students were Donald W. Douglas, who designed the World Flight cruisers. During the

(*Continued on page* 108)



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Simple Aerodynamics

Elementary Principals of Flight

By Alexander Klemin
Daniel Guggenheim School of Aeronautics, New York University

THERE is a certain similarity between airplane flight and swimming. If a man in deep water remains motionless he will sink. When he is swimming the reaction of the water against his moving body will support him. To attain movement through the water he must exert muscular energy, propelling himself by the use of arms and legs against the resistance of the water. In the airplane, the wings or supporting surfaces meet the rush of air and experience a lift which sustains the plane against the action of gravity. The thrust or pull of the propeller, actuated by the power of the engine, overcomes the drag or resistance of the plane to forward motion.

Fig. 1 illustrates the movement of a flat plate through the air when inclined at a small angle to the direction of motion. A lift force at right angles to the motion and a drag or resistance force parallel and opposite to the direction of motion are experienced.

Principle of Relative Motion

A stationary object with air moving by at a certain speed will have the identical forces acting on it as an object moving through the air at that speed. This may be termed the Principle of Relative Motion. The "relative wind" then determines the amount and direction of the air forces. In flight the speed of a plane relative to the air may be greater or less than its speed relative to the ground. When flying against the wind its air speed is greater than its ground speed and vice versa.

In rowing a boat, when the oar is submerged we must exert a great deal of energy to move the oar against the resistance of the water. When the oar is raised above the water for the return stroke very little effort is required to move it back through the air. This indicates that the resistance offered to the movement of a surface depends upon the density of the medium through which it is moving. We may say that the more dense a fluid is, the greater is the resistance it offers to motion.

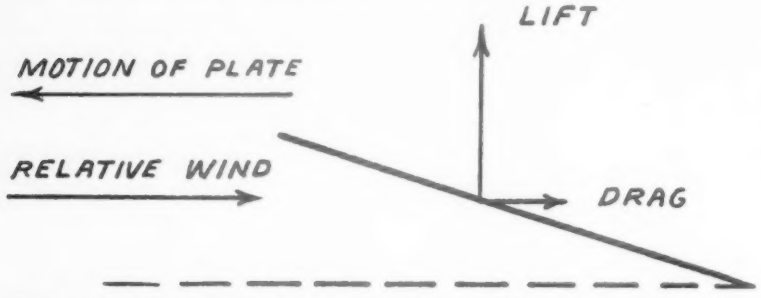


Fig. 1. Lift and drag of a flat plate inclined to its direction of motion.

Variation of Resistance of a Flat Plate Normal to the Wind with Density, Area, and Velocity

A flat plate of one square foot area held perpendicular to the relative wind will offer a certain amount of resistance to motion; a plate of twice the area will obviously offer twice the resistance and so on. Thus the resistance varies proportionately to the area.

In driving an automobile at 30 m.p.h. we hardly notice any air resistance. At 60 m.p.h. there is an appreciable air force retarding motion and the wind howls in our ears. We can feel that this force is not merely twice that at 30 m.p.h. but much greater. In moving at 60 m.p.h. we are not only hitting twice as much air in a given time but we are hitting each particle just twice as hard as at 30 m.p.h. Thus we can see the resistance effect of the air will vary as the square of the velocity. The air resistance at 60 m.p.h. then is four times that at 30 m.p.h.

We have now established the fact that *the drag or resistance of an object varies proportionately to the density of the medium in which it is moving, the area of the object, and the square of the velocity.*

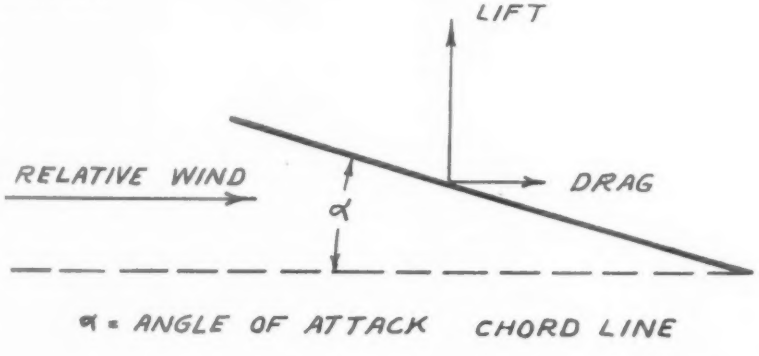
Weight, Mass, Specific Weight and Density

If an object has a weight of one pound, it is acted upon by gravity with a force of one pound.

The force of gravity varies somewhat with the distance from the equator, and with the height above the earth's surface.

The force of gravity, g, is defined according to international standards by saying that a force of one pound acting on a weight of one pound produces an acceleration of 32.174 feet per second (written ft./sec.^{2}).

Fig. 2. Chord and angle of attack for a flat plate.



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While the weight of an object depends upon the value of gravity, the amount of matter or mass in an object is evidently independent of gravity.

In physics or aerodynamics it is very often useful to work in terms of mass rather than of weight. The mass of an object weighing one pound is said to be

$$\frac{1}{g} = \frac{1}{32.174} \text{ or } M = \frac{W}{g}.$$

In article 2, we stated that standard air, at 29.92 inches of mercury pressure and 59° Fahrenheit temperature had a density of .0764 pounds per cubic foot.

We would have done better to call this the specific weight. The density is really the mass per cubic foot. The mass or density per cubic foot of Standard Air will then be

$$\frac{.0764}{g} = \frac{.0764}{32.174} = .00238.$$

The density of air is generally denoted by the Greek letter ρ (rho). Mass is denoted by the symbol M.

Momentum, Acceleration and Force

Momentum is defined as the product of mass by velocity, $Mv = \frac{Wv}{g}$.

Example. What is the momentum of a weight of 10 pounds moving at a speed of 10 feet per second? The mass is $\frac{10}{g} = .31$. The momentum is $Mv = .31 \times 10 = 3.1$.

In Article 1, we saw that

$$F = \frac{Wa}{g}.$$

Therefore F = Ma or force equals mass times acceleration.

If a body of Mass M acquires a momentum Mv in one second, then the acceleration is also v and the force exercised will be proportional to Mv or the momentum acquired in one second.

Mathematical Proof of the Resistance Law

We can, with the aid of the above paragraphs give a mathematical proof of the resistance law.

Imagine a flat plate held normal to a stream of air. The amount of air striking the plate depends upon the density of the air, the area of the plate, and the velocity of the air. We can therefore write that the amount of or mass of air M is proportional to ρAv where

ρ = density
A = area
v = velocity.

Fig. 3. Chord and angle of attack for double-cambered surfaces.

The amount of momentum which the plate must take up per second is proportional to Mv. Thus the resistance or force experienced by the plate must be proportional to Mv, and since M is proportional to ρAv, R is proportional to $(\rho Av) \times v$ or ρAv^2.

Resistance of a Flat Plate Perpendicular to the Wind

The great Newton imagined the flow of a fluid to consist of the movement of a great number of individual particles. He thought that if a flat plate was held normal to an air stream, all the particles after striking the plate would fly off sideways with the forward velocity completely gone. Then the force on the plate would be given by the equation $R = \rho Av^2$. Experimentally, however, it has been proved that R does not equal ρAv^2 but is only proportional to it, because the air does not quite follow Newton's simplified conception of its behavior.

The American aeronautical engineer in the calculation of flat plate resistance employs the equation:

$R = KAV^2$

where K = Constant derived from experiment
A = Area in square feet
V = Velocity in M.P.H.

The value K is known as the Coefficient of Resistance. It has been found more convenient to include the density (rho) directly in this constant. For the case of a large square flat plate held perpendicular to the wind the value of K = .0032 has been generally accepted as sufficiently correct.

Example: Find the resistance of a square flat plate 16 square feet in area held perpendicular in a 60 mile wind.

$R = KAV^2$
$R = .0032 \times 16 \times (60)^2$
$= 184.32$ pounds.

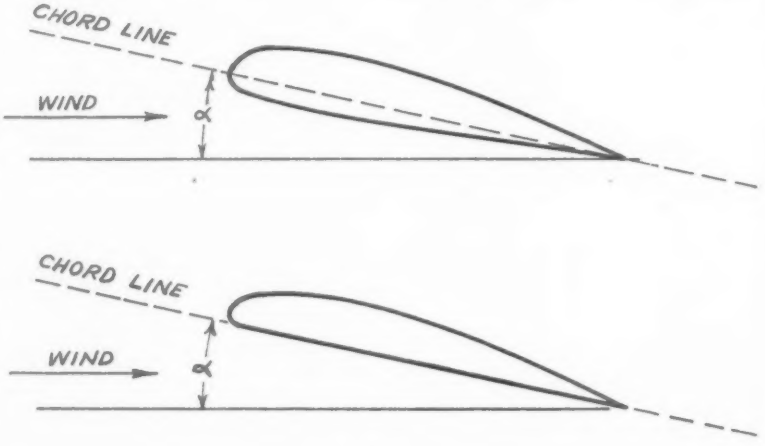
General Law of Variation of Aerodynamic Forces

When a surface is inclined to the wind there is created a lift force as well as a drag or resistance on the surface. These forces are as shown in Fig. 1. By analogous reasoning to that in a preceding paragraph it may be shown that the lift force on an inclined surface will follow the same law of variation with density, area, and velocity squared. In fact all aerodynamic forces follow a similar law. For each kind of force and every different surface the constant K will change but in each case is readily determined by experiment.

Angle of Attack

We have seen that two forces, Lift and Drag, are produced when a flat plate is moved inclined to its direction of motion, or to the relative wind. Since these two forces vary with each inclination, even if the speed is constant, it is important

Fig. 4. Chord and angles of attack for various airfoils.



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to define the angle of inclination for all surfaces.

For all surfaces, whether flat plates or curved (cambered) wing sections, the angle of inclination is termed the angle of attack, and is defined as the acute angle "a," expressed in degrees, between the relative wind and a line in the section termed the chord.

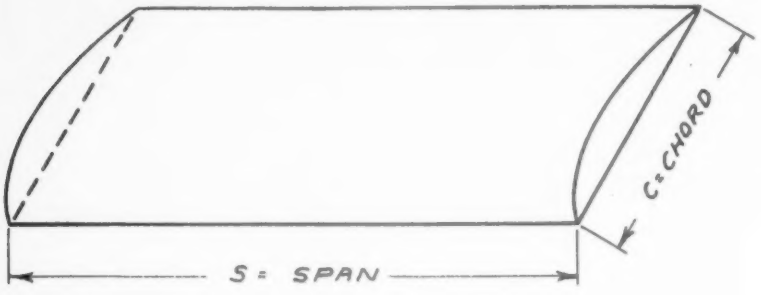


Fig. 5. Span and chord of a wing.

In the case of the flat plate shown in Fig. 2, this line coincides with the surface of the plate. In a symmetrical, double-cambered section, as shown in Fig. 3, the position of the chord is not in doubt. In a wing section, cambered section, or airfoil as it is variously called, there is always doubt as to what is the chord line. It is generally fixed by the original designer of the section. Some representative examples are shown in Fig. 4.

Span, Chord and Aspect Ratio

In Fig. 5 the meaning of the terms Span and Chord as applied to an airfoil is illustrated. The chord length is the distance between the leading and trailing edges measured along the chord line. The span is the width of the wing, or the length from tip to tip. It has been found that the aerodynamic properties of a wing depend not only upon the shape of its cambered section but also upon the ratio of span to chord. This ratio has been given the name of Aspect Ratio ($\overline{AR}$). Thus for a wing rectangular in form:

$$(\overline{AR}) = \frac{\text{Span}}{\text{Chord}} = \frac{S}{C}.$$

Lift and Drag Coefficients

In Fig. 1 was shown a flat plate inclined to the relative wind, with the force L, or lift, perpendicular to the wind, and the force D, or drag, along the line of the wind. These values of the lift and drag vary as the product of density, area and velocity squared as we have shown. The airflow varies for each angle of attack, however, so there must be different coefficients for each such angle. These coefficients also vary with each different shape of wing section. We may write the equations for lift and drag as follows:

$L = K_y AV^2$ and $D = K_x AV^2$

where

L = Lift in pounds
D = Drag in pounds
A = Area in square feet
V = Velocity in m.p.h.
K_y = Coefficient of lift for a given angle and section.
K_x = Coefficient of drag for a given angle and section. As in the formula for the resistance of a plate normal to the wind the density is included in the constant for convenience.

Example: Given a rectangular wing of 30 ft. span and 5 ft. chord with a coefficient of lift = .0028. Find the lift force at 50 m.p.h.

Area = $30 \times 5 = 150$ sq. ft.

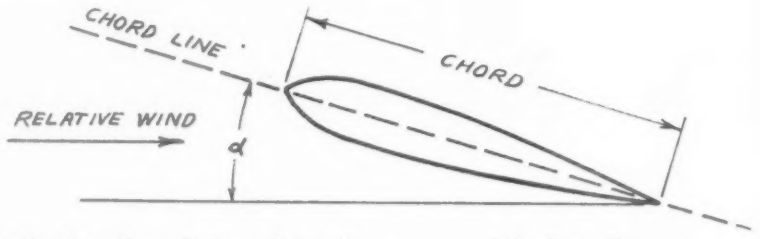
$L = K_y AV^2$

$L = .0028 \times 150 \times (50)^2 = 1{,}050$ lbs.

The same wing has a drag coefficient of .00034 at the same angle of attack. Find the drag force at 50 m.p.h.

$D = K_y AV^2$

$D = .00034 \times 150\ (50)^2 = 127.5$ lbs.



Lift Over Drag

The ratio of lift over drag, L/D, is evidently a measure of the efficiency of the wing. The value of L/D is also equal to the ratio of lift coefficient to drag coefficient $K_y K_x$ for

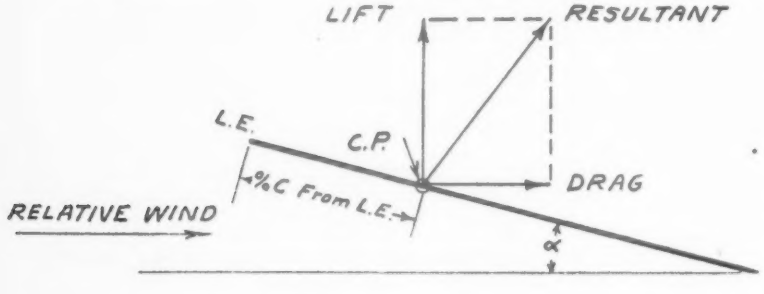
$$L/D = \frac{K_y AV^2}{K_x AV^2} = K_y/K_x.$$

Resultant Force and Center of Pressure

The two forces, Lift and Drag, of Fig. 1 may be combined into a single force known as the Resultant Force. This has been done in Fig. 6. It should be noted that the resultant force is not usually perpendicular to the chord.

The point of application of this force along the chord line is called the Center of Pressure (C.P.). The position of the C.P. is designated by its distance from the leading edge of the surface given as a percentage of the chord length. Thus if the chord length in Fig. 7 be 60 inches and the resultant force act at 15 inches from the leading edge, its position would be given by 15/60 = 25 per cent of the chord from the leading edge. Briefly, it is said that the C.P. acts at 25 per cent of the chord.

Fig. 6. Resultant force and center of pressure.



(Continued on page 97)

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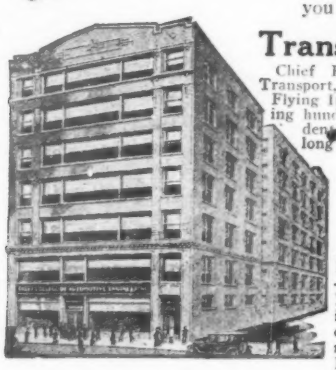

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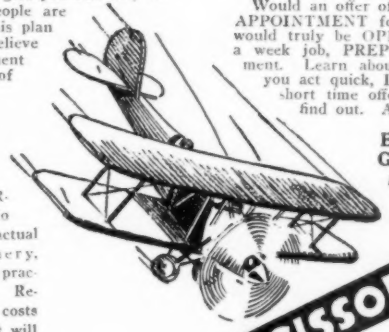

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Airplane Design and the Public

By J. Don Alexander

President, Alexander Aircraft Company.

THE airplane manufacturer has to deal with a spoiled public, and a public already exercising a dominating influence in aircraft design. It is, in fact, the same public which has ruthlessly shaped the development of every other common conveyance.

The fact that the public has become "spoiled" by the traveling comfort of the auto sedan and the railway coach is no reflection on the people. Most of our time and energy is devoted to keeping ourselves comfortable—let the cynics make merry. The steady advance of the cabin airplane is an outgrowth of this same universal desire.

One of the most encouraging trends in the industry today is the rapid adoption of airplanes by business executives. With them speed is essential. The sales manager who covers his territory by plane is naturally the type of man who doesn't care to waste time, even when traveling at 135 miles per hour. He wants to work as he flies. In the open cockpit airplane he may be cowled in completely from the slipstream, yet the roar of the motor and the close quarters are a continued distraction. Consequently the up-to-the-minute business leader is using a cabin job instead of a fair-weather ship. This type of commercial worker is bringing about the future airplane.

The "office-plane" of the future, will be known as weather proof. It will be enclosed, offering better protection and year-around operation. It will be speedy, yet not a plane that will reach a top speed of 135 miles per hour, and be forced to land at 100 miles an hour. It will be able to cruise well above 100 miles per hour, and land at 35 miles per hour, without forcing the pilot to resort to skillful sideslips and swishtails. It must perform at high altitudes, and keep stable in rough air. The take-off necessarily will be quick and the climb rapid, for the business man cannot gamble on landing or taking off of some of the small baseball diamonds which have been dignified with the name "airport."

This plane eventually will be produced as a result of the powerful, ever-present force known as public influence. Indications are that we will not have to wait long.

The monoplane with its trim appearance and aerodynamic efficiency has caught the popular fancy in the last few years, undoubtedly as a result of the oft-mentioned distance flights.

From an engineering standpoint, for swift travel without sharp maneuvering, the monoplane has the edge on the old dependable biplane. It has been left for aircraft architects, however, to develop a monoplane with the steady aileron control and slow landing speed of its double winged contemporary. This is being done.

Even above speed, the public demands safety. The salesman wants to be assured of reaching a certain destination, quite as if he were pursuing the slower ground travel. He demands this assurance both in the interests of business and personal well-being.

This very reasonable request is being satisfied with increased dependability of power plants, stronger airplane structures, and the aforementioned progress in attaining slow landing speed. The airplane safety ratio is now comparable to that of other swift transportation mediums and it will be brought even higher.

It will be many years before aerial traffic becomes a problem over large population centers. To cope with congestion before congestion arrives, we will make planes with greater visibility. Not only will the pilot be able to see in front and below him, he will be able to see above him, and so avoid any plane which may be landing on him.

In the fish, Mother Nature has achieved the perfect streamline. Consequently the swift light plane will adopt the general lines of a trout or salmon, to decrease resistance and afford greater speed. Such a piscatorial model will make for a clean cut appearance. Monoplane wings of the strong full-cantilever type, requiring no exterior bracing, will reduce parasitical resistance to an extremely low point. New metal alloys will be incorporated in a lighter and stronger ship. The less the weight of the plane is, the more pay load the plane can carry, of course. Another great increase in speed will result from folding landing gear, which can be drawn up under the fuselage. This feature alone should add 10 miles per hour to the speed.

In another respect, the development of the ideal airplane is paralleling that of the modern automobile. Greater attention is being turned to the comfort of pilot and passenger. Seats will be reclined and upholstered in a manner that will cause comfort to assume new meaning in cross-country travel.

Propellers reach maximum efficiency at a fewer number of revolutions than is now compatible with high powered motors. The future plane will be equipped with a slow-speed motor, developing ample horsepower at 1,000 r.p.m. This type of motor will afford less gas consumption, enabling the plane to travel farther and faster on the same amount of fuel. Radial motors will be cowled in, and even the cylinders will be stream-lined with fairing.

A tail-wheel in place of the skid will enable the light plane to take-off after a shorter run, consequently making operation possible from smaller fields.

Night flying will be assisted by the use of landing lights, streamlined into the structure. Every plane will be equipped with a starter, and cranking will be as rare as with the present-day automobile. One man will be able to wheel the ship into the hangar, and bring it out. This is difficult for a single person to do with the modern light biplane.

Improved generators will charge batteries for starting, ignition and lighting.

A significant step forward will be the general adoption of adjustable-pitch propellers. Such a feature will enable the pilot to take-off with his propeller set at a low pitch. He will gain lifting speed more quickly, and

(*Continued on page* 121)

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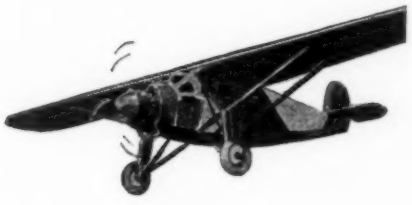

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A Forced Landing in the Bahamas

By Gordon Bazely

TWO schooners which had been lying at Gun Cay in the Bahama Islands were feared lost in the storm which swept over that locality some three weeks ago, and when I received a telephone call from Captain Arthur Holland of the seaplane Topsy Fish asking me if I would care to accompany him on a trip to Bimini and Gun Cay in search of the two vessels it is not surprising that I ignored lunch in a hurried dash to the slipway from which the Topsy Fish was wont to slide into the beautiful waters of Nassau harbor.

Armed with a camera and binoculars and dressed only in our linen suits we set out at about 1:30 p. m., August 8th, and making east towards the Fort Montagu Hotel we circled gracefully over Hog Island and proceeded down wind towards Andros Island, some 40 miles west.

There is no better way of seeing the Bahamas than from the air. The wonderfully transparent sea, in its shimmering, ever-varying tones of emerald and turquoise, takes on more wonderful hues from the sky, and it did not seem long until we had left the white waters of the sponge grounds behind us, and were out over the ocean, heading by compass for the far off islands.

Out of sight of land we ran into a bad storm, which—like the Red Sea—divided as we approached, leaving a narrow passage between the rain areas, through which we flew. It soon became apparent, however, that there was more trouble ahead. A curtain of inky darkness hung over the horizon, and as we approached we saw that there was a violent storm raging under the mile-high thunderheads.

To go over was impossible, and to attempt to fly through was out of the question. We should have been beaten down and immediately swamped in the violent seas. Yet we knew that Bimini was not more than five miles away, in the center of that inferno. Our gas was limited, and so, after making an unsuccessful effort to find a gap, we turned back for Andros, only to be confronted with another problem.

For some 80 miles we had not seen land, and it was accordingly necessary to resort to dead reckoning as we hurried eastward. Very soon we ran into a rain storm which stung our faces and hands as we vainly searched for the thin grey line which should appear. The moment was approaching when our gas would give out. Could we make land?

Suddenly a grey mass broke through the haze and we saw land dead on our course. Soon we could see fishing boats lying at anchor in Red Bay, the fishing settlement we had been making for. Only two miles separated us from them when, with a sputter and a cough, the engine stopped.

We were only a few feet above the sea and Captain Holland made a wonderful landing across wind. The moment we were down he seized the wooden hatch cover, and with a few blows of a hammer turned it into a sea anchor which he tied to a rope trailing from our bows, and which served to keep our head to the wind and control our drift.

Fortunately the wind had dropped, but sounding showed deep water, so there was nothing to do but sit tight. We photographed each other and looked around for the possibility of escape. It was then that I found there was neither food nor water on the ship.

For an hour and a half we drifted gently north-east towards a group of cays which lay on the horizon, but it soon became apparent that the current had altered and that we were turning out to sea. Tying a rope to himself, Holland jumped overboard and found to his surprise that the water only came up to his neck. I was not long in following him. Together we sarted off, towing the useless plane behind us, towards the nearest of the islands.

Darkness came on with the usual rapidity of tropical nightfall, and we were left to make our way by starlight in a sea swarming with barracuda and shark, either of which might very easily have incapacitated us. More and more slowly we dragged the boat. Would the island never come nearer? The water was now only up to our knees.

A sudden flash of phosphorescent fire approached at an unbelievable speed, and a fish came straight at me, passing with a leap from the water right between my outstretched legs. The fish was a small barracuda. I do not know whether Holland or myself was first onto the plane. I only remember that I lay panting for fully five minutes before either of us could get down into the sea again to continue our labor.

All around strange shapes passed through the water leaving trails of liquid fire, and it was with a feeling of great relief that at 8:30 p. m., after towing for 2½ hours and covering some eight miles, we stumbled ashore on a sandy beach at the north end of the southernmost Man-o'-War Cay.

We had no matches, but by taking off the magneto booster and the priming can of gasoline we had a very efficient method of making fire. In order to quench our thirst, we ran the radiator water off into a gasoline can and attempted to drink it. A more nauseating draught cannot be imagined. Oil and rust were mingled with a flavor of brass solder, and the mixture was lukewarm.

Gordon Bazely, of the British Water Colour Society, is an artist and etcher. He was born in Penzance, England, 27 years ago. He received his education at Goldsmith's College, London, and has been in the Bahamas for two years.

Arthur R. C. Holland was a captain in the Royal Air Force. He is English, is about 30 years of age, and has been flying for the last ten years, with the record of never having lost a passenger. Capt. Holland is pilot and part-owner of the Topsy Fish.

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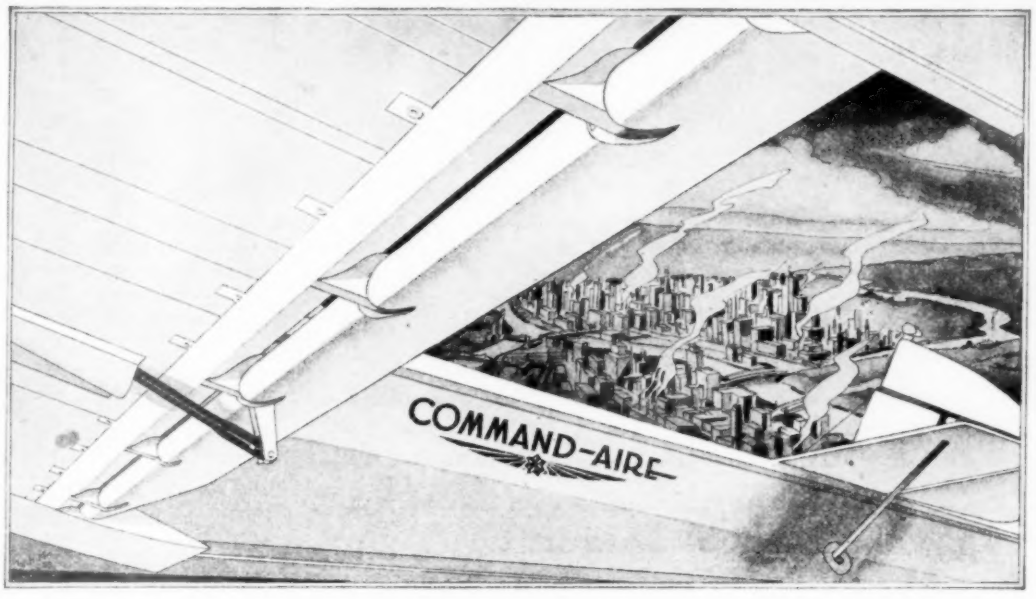

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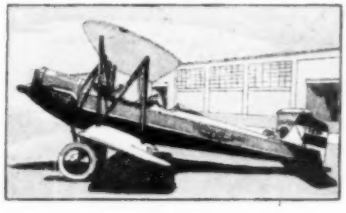

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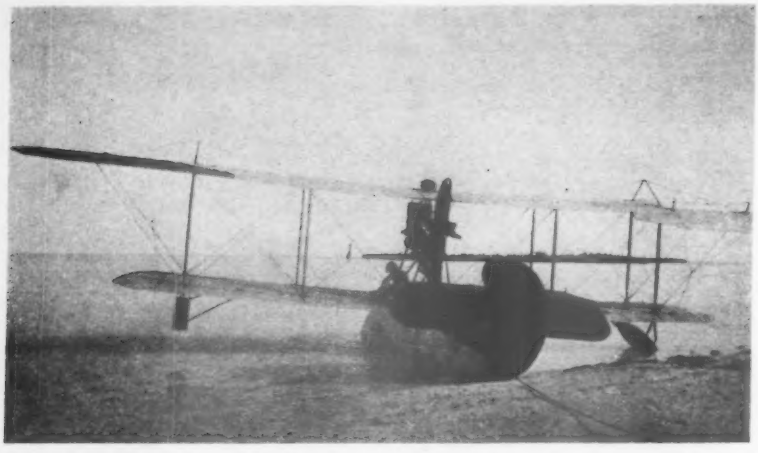

Dismantling the Topsy Fish on the beach at Man-o'-War Cay.

How we managed to retain the few drops we drank I do not know, but retiring early to our sandy couch under the stars and keeping as still as possible, we hoped for the best.

In a few minutes we were surrounded by swarms of large mosquitoes, which did not leave us alone for a single moment all night. It is not surprising that at the first signs of dawn we were up exploring our island. We lighted a fire to attract the attention of any boat that might pass.

We found that we were on a small circular sand bank, covered with scrub and a few struggling palmettos. The milk-white waters lapped mournfully at the mangrove roots. There was only one bright spot in the outlook. The water was probably shallow all the way to the mainland, 20 miles away, and should we be able to make a raft we could start poling our way to civilization. Owing to the absence of a lumber yard on our island, this scheme was abandoned.

Suddenly Holland had an idea. We would dismantle the plane, put our water and clothes with the binoculars and camera in the cockpit, and tow the hull behind us. Holland had no sooner thought of this plan than he sprang into action and commenced the tremendous task of taking to pieces a full sized flying boat with nothing but his emergency tool kit. Too exhausted to be of much use, I lay on the beach while he undid the nuts and bolts securing the engine mounting and wings. Then with great caution we worked the wings off and dragged them above high water. During this process I was bowled over by a wing section and half buried in a mixture of sand, clay, and salt water. From this time on despite the burning sun, I worked in nature's garb—an action which I afterwards regretted.

After we had removed the wings we made a rope fast to the engine on the now top-heavy hull, and rocked it until it fell overboard into the sea, missing the delicate hull by the fraction of an inch.

By noon we were ready to go, and after a rest we wrote a message in oil on one of the wings, stating that we were making for Andros. This done, we set out for the next cay, towing our hull after us. After some two miles of wading we came to a deep channel where we were forced to swim, holding onto the hull as we did so. Just as we were becoming exhausted we again touched bottom. and we proceeded to slog on through the slimy clay which coats the coral sand eighteen inches deep. Finally, at about 4:30 p. m., we hit the beach, and after exploring the island found that it was even more barren and desolate than the one we had left, although there were many more crabs.

Wings ashore and engine overboard, the Topsy Fish is ready for the voyage to the mainland.

A tarpaulin was stretched over the cockpit in an attempt to catch rain water, but all storms passed us on one side or the other. We saw a fishing boat, and again brought the magneto booster and can of gasoline into play, but to no avail.

At this point we succumbed to the effects of our vile beverage. We were both sick, and after feeling very bad indeed we decided to confine our efforts with the radiator water in the future to merely wetting our lips, swallowing nothing. About 7 p. m. we fell asleep, and except for the mosquitoes and the smudge fire, which needed occasional tending, we spent a peaceful night.

Up before dawn the next morning, we decided to make one great attempt to reach the mainland before noon. So, without stopping except for an occasional immersion to cool our thirst as much as possible, we struggled on through the forenoon. Mile after mile we made our way, treading on fish and crabs, and poling across deep water channels with a piece of plank, until, around the next cay, we saw a sloop only some three miles away sailing towards civilization. On we went, trying from time to time to attract the attention of the boat, but without success. Finally we watched it sail away out of sight.

We had covered some 14 miles like this when, poling along in deep water, Holland suddenly shouted that a skiff was approaching. In a few minutes two Lowe Sound fishermen were alongside, and we had transferred our allegiance to their sail boat, after anchoring the hull with the tool box on board.

We found that the distant land was yet another cay and that, had

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THE SWALLOW AIRPLANE CO.

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With the Topsy Fish forced down at sea, Capt. Holland considers it is a good time to sit for a portrait.

we landed and walked across, we should have had the bitter disappointment of seeing a deep channel stretching between us and the mainland, which lay another two or three miles beyond.

Our rescuers had no food or water aboard, as they were merely out picking thatch for their house. They at once gave chase to the vanished sloop, which was known to carry a certain amount of water, and after some two hours' rowing and sailing, we were able to attract the attention of the captain. He dropped anchor and before long we were on board. We each drained two large mugs of water from a barrel which was kept on deck, and had some sour bread, baked after the native fashion, but very agreeable to us on this occasion.

The fishermen, who were all colored, were towing another sloop which had been damaged in the recent hurricane. We left directions with them for salvaging the hull of the Topsy Fish, and in still another skiff set off on a stormy voyage to Nicoll's Town.

The wind had freshened, and for the next four hours our little sloop tacked backwards and forwards, taking big green combers abroad frequently. We spent a strenuous time bailing the water from the bottom of the boat. About 4:30 p. m., 48 hours after we had come down at sea, we saw a Waco seaplane making towards us over a promontory called Morgan's Bluff. It circled around, and much to our disappointment, headed off to the west. Soon it was back again, however, and as it passed overhead the pilot, Captain A. B. Chalk of the Chalk Flying School of Miami, signalled to us that he would wait for us at Nicoll's Town.

We arrived at Nicoll's Town at six o'clock and were welcomed by the entire population under the leadership of Mr. O'Brien, the Commissioner. After eating some fruit that Chalk had given us we went up to the Residency where we took a bath and changed into clean clothes supplied by the Commissioner. Here we had supper.

Seated on the piazza after the meal we were surprised to see three men approaching us. We found that they were Messrs. Collie, Holt, and Russell of Nassau, who had come out in the yacht Dorothy with food and medical supplies. The meeting was hilarious, and we began to realize that great anxiety had been felt for our welfare in Nassau.

This story won the $100.00 watch offered each month for the best "Forced Landing" story sent us by the participant in the landing. You can see by this story how much the photographs help. Address "Left Wing Low" — Popular Aviation, 608 S. Dearborn Street, Chicago.

After a long night's rest I made an early morning start with Capt. Chalk in his seaplane and by breakfast time we were in Nassau, and seated in my studio recounting our experiences to our friends. The Dorothy had gone back to collect the pieces of the Topsy Fish.

A rumor had spread that I had arrived in a weak and ailing condition, but I was able to show that, on the contrary, I was physically the better for our adventure. At the same time I should not want to do it all over again.

A week later the pieces of the plane were brought into Nassau, and the work of rebuilding the ship and cleaning out the engine was commenced. The Topsy Fish will fly again, and I hope that I shall fly in her. There was nothing the matter with the plane or the engine or the pilot. We simply had sheer bad luck in regard to weather.

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Air mail stamps are acceptable for the payment of the registry fee as well as for the payment of postage on any registered articles which are actually sent as air mail. This announcement was made recently by the third assistant postmaster general, R. S. Regar:

"Information has reached this office indicating that some postal employes are under the impression that air mail stamps are not acceptable for the payment of registry fees on registered air mail and in this connection may have misconstrued the statement in the third paragraph of the matter printed on page 223 of the June, 1928, Postal Guide, wherein it is stated that the use of air mail stamps on other than air mail is not permissible. Postmasters and other postal employes are therefore informed that air mail stamps are acceptable for the payment of the registry fee as well as for the payment of postage on any registered articles which are actually sent as air mail."

Rescued by two Bahama thatch-gathering fishermen.

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Lighting the Airport

By D. W. Blakeslee, E. E.

EVERY city of any size now has, or expects to have, an airport. Most cities and many towns now have one or more aviation fields; but the rapid growth of commercial flying, the tremendous acceleration in the growth of volume of air mail, and the wonderful increase of air-mindedness of the general public, make the municipal airport a necessity. Whether it be a privately owned aviation field, or a publicly owned airport, the time has now come when the flying field must be illuminated for night flying.

In the present state of civilization, it is unthinkable that business, sports and recreation should stop with the end of daylight. Our present modes of life have developed only because of the advancement of artificial lighting. For the further development of aviation airports must be illuminated for night flying. It is lamentable that pilots, now carrying U. S. Mail, must frequently make landings on aviation fields which are not properly lighted. All aviation fields must very soon be illuminated, if they are to give the service for which they are intended.

The great importance of aeronautics in warfare indicates the necessity of accelerating the development of night flying to the greatest rate possible. Experience in the zone of advance, during all eleven major operations of the World War proved to the writer (56th Engineers; Anti-Aircraft Fleet Searchlight) that the enemy bombing plane can be best combated by night flying pilots in swift airplanes, with machine guns. For the promotion of more efficient peace-time operation, all pilots of planes should practice night flying. This can best be accomplished with the aid of adequate illumination of present and future airports.

To assist in the satisfactory illumination of airports, the Aeronautics Branch, U. S. Department of Commerce, in its bulletins on Construction of Airports and Airport Rating Regulations, devotes 40 per cent of the volume of these publications to the various stages of the subject of Lighting of Airports.

The equipment for airports, completely lighted for use at night, includes the following: (a) Airport beacon; (b) illuminated wind direction indicator; (c) boundary lights; (d) floodlights; (e) signal lights; (f) ceiling projector; (g) building floodlights; (h) obstruction lights. Some night flying pilots are now advocating (i) landing strip marker lights.

The airport beacon must be at least a 100,000 candle-power, 24 in., rotating projector, or it must be a fixed lens or combination of lenses with flashing light sources, flash panel lenses, or Neon tube lights, with or without optical apparatus, to produce the effect of flashing. The light must be of not less than one-tenth second duration, with a luminous period not less than 10 per cent and with frequency of flashes having eclipse not greater than 10 seconds.

Wind direction indicators, whether of the tee or cone type, may be lighted by one of a number of ways. The U. S. Air Force Association advocates the use of the 500 watt floodlight for illumination of the wind cone.

The boundary lights must follow the outline of the useful area of the landing field, and must be spaced not farther than 250 ft. apart. A spacing of 200 ft. is more desirable and for smaller fields, the spacing should be still less. Boundary light lamps should be enclosed in weatherproof globes, located about 3 ft. above the ground, at the end of a piece of 1 inch conduit. For the sake of economy, the conductors in the circuit around a large aviation field should be in a Parkway or Trenchlay cable, which requires no conduit for its protection. For a large airport, the series circuit with a constant current transformer will be found to keep to a minimum the cable cost

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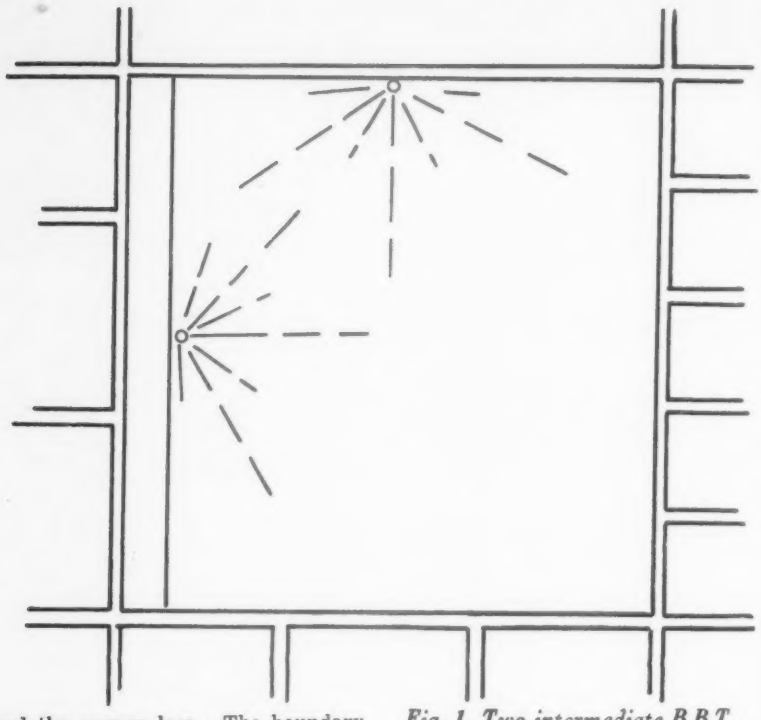


Fig. 1. Two intermediate B.B.T. floodlights with the 5 kw. incandescent lamp. The B. B. T. light is of the wide-spreading, lighthouse type.

and the energy loss. The boundary lights shall show white, except at each end of each landing strip, where there shall be a green one on a center line of the landing strip. On the series circuit, the lamp to be used in the boundary light is the 600 lumens, 6.6 amperes, S-24.5 lamp; for the green light, a 1,000 lumens lamp should be used. If a multiple circuit is used on a small field, the white light must be not less than 25 watts and the green not less than 50 watts.

The floodlights for the surface of the field itself, may be of one of two general types: (1) An adaptation of the lighthouse system of hand ground Fresnel lenses, to spread the light horizontally; (2) The typical floodlight, with reflector and dioptric lens, for controlling the light by spreading it horizontally and depressing the light, which would otherwise be lost above the ground, into the main beam. Fig. 1 and Fig. 2 illustrate the application of these two types respectively. The floodlights should illuminate the entire useful area of the landing field and not simply the landing strips which may have runways especially prepared to provide better surface than the balance of the field. The required average intensity for illumination of the field is 0.15 foot-candles. The floodlights are usually mounted from 5 to 15 ft. above the ground. They should illuminate the field so as to reveal details of the surface and make depth perception possible from an altitude of 30 ft. The floodlight system must be able to cover a field having a somewhat irregular, wavy surface, without shadows. A sharp cutoff is necessary to prevent blinding the pilots by glare from the lights.

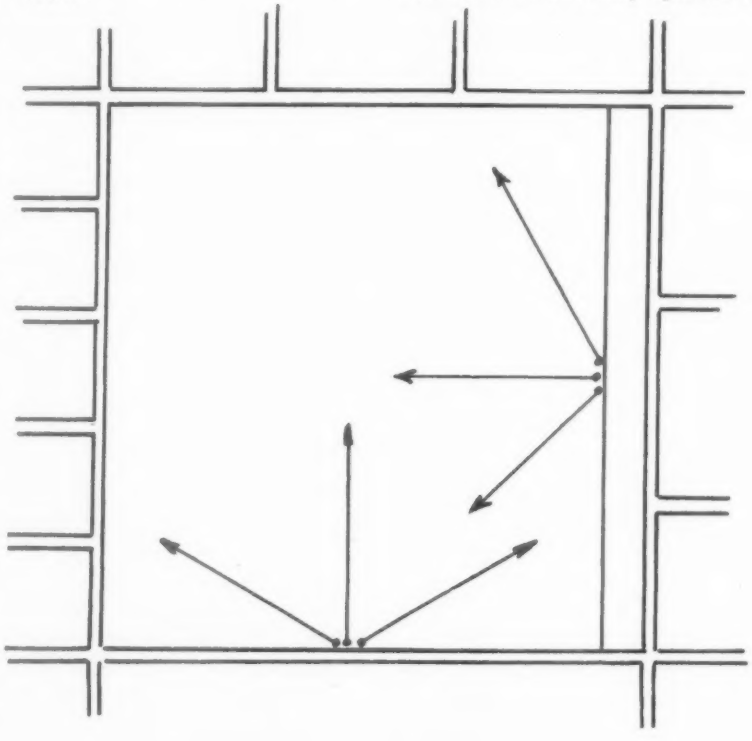
An example of the first type of floodlight mentioned above is that of the B. B. T. Corporation of America. (See Fig. 3.) In this unit, the front half of a cylindrical housing is composed of a 21-element, 180 degree, hand ground, Fresnel lens, approximately 3 ft. high and 3 ft. in diameter. It is claimed that this unit gives a fan of light with a very narrow, vertical divergence of about 2 degrees.

This unit is also provided with a narrow, vertical screen, which can be adjusted in any direction desired, to reduce the amount of direct illumination and provide a dark sector in the direction of the aircraft about to land or taxi on the field.

Its light source consists of a 150 ampere, high intensity arc mechanism, or a 10 KW. incandescent lamp. Direct current at 115 volts is required for operating the arc, and the generating equipment and control apparatus are usually installed in the shed housing of the floodlight.

A spherical reflector can be used to advantage with the 10 KW. incandescent lamp, the illumination being less intense and of greater vertical divergence than from the arc. The fact that this lamp operates on

Fig. 2. Six "Pittsburgh" airport floodlights with the 1,500 w. general service lamp. These lights concentrate the beam somewhat more.



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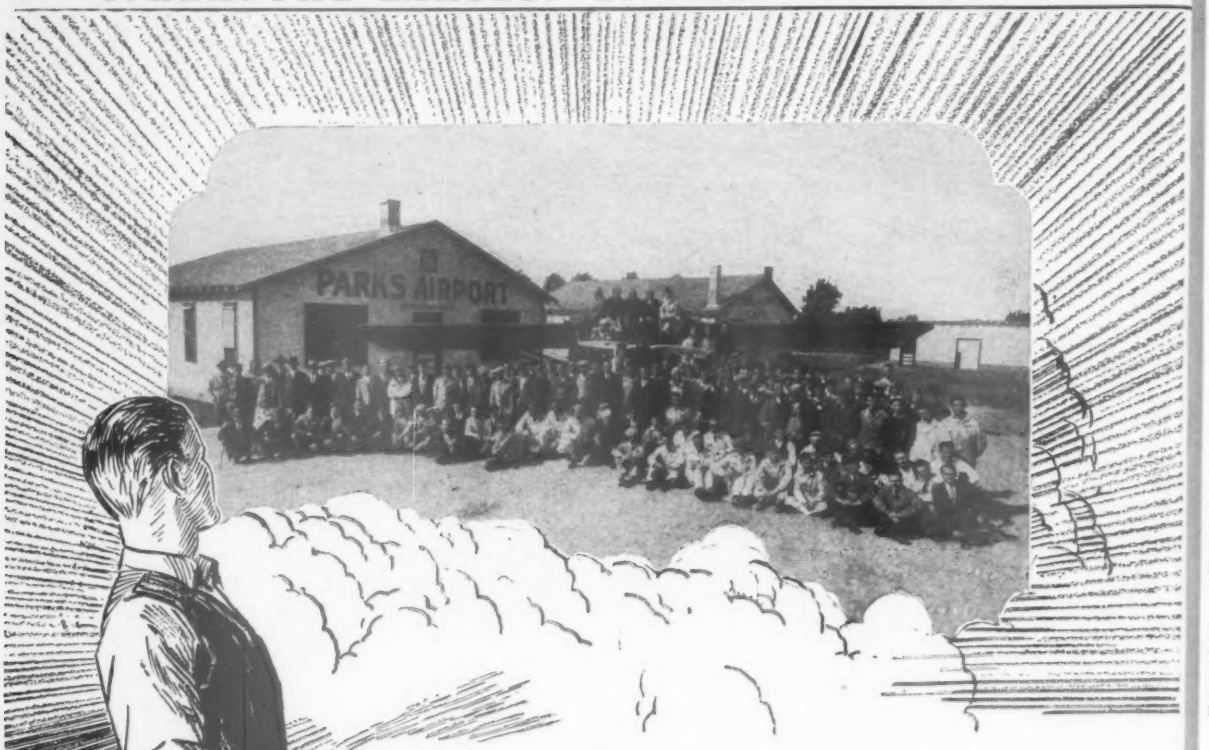

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Students are enrolled from every state in the Union and from several foreign countries. Parks is putting many more men into aviation than any other school in the world.

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Students are daily choosing Parks after personally inspecting many other schools. One says: "I selected Parks over eight other leading schools. You are decidedly in a class by yourselves."

FACTS FOR AVIATION SUCCESS

your chance of success, in this as in any field. Graduates of "Freshwater College" sometimes achieve fame — but it's a hard battle. The man from Cornell, or Yale, or Columbia, has long odds in his favor from the start. And for very good reasons.

Coming in for a perfect landing

And the big school, properly managed, can offer complete training at no greater cost—sometimes at less—than a small place must charge. It actually costs you no more to learn aviation at Parks Air College than at schools which offer you nothing like Parks' opportunities. Parks has over 400 students in training. No other civilian school in the country has half that number. Parks has 14 licensed transport pilots as instructors—26 new-production ships—over $175,000 worth of plant and equipment. Parks is more than an aviation school—it is a University of the Air.

What School Offers Most?

Your problem, then, is to choose the school that gives you the best start—the school that equips you fully for what lies ahead of you in aviation.

Only a big school can do that. No small institution can afford the lavish equipment—the famous pilots—the skilled instructors.

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Ask at once for your free copy of the new 32-page edition of "Skyward Ho!", profusely illustrated with over 100 photographs. It describes and pictures Parks Airport, the College, the shops, the courses, the planes, the instructors, and students. It's fascinating—and full of real information on flying as a career.

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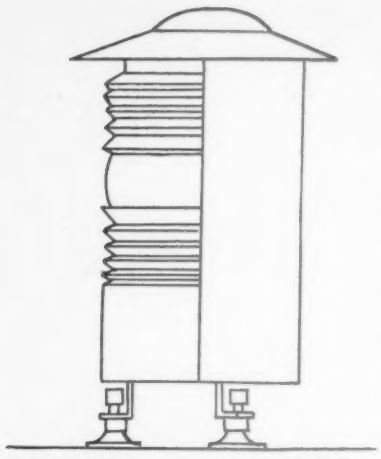


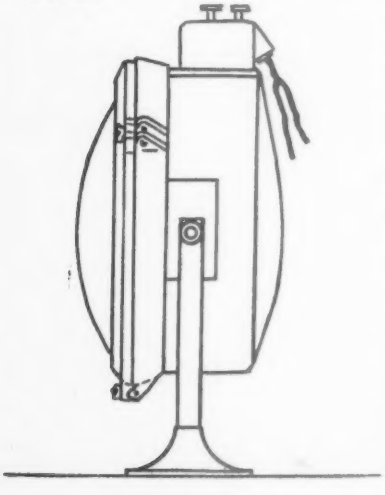
Fig. 3. Side view of the B.B.T. floodlight. The 180 degree Fresnel lens is approximately three feet high and three feet in diameter.

either alternating or direct current, and entirely independent of an operator, makes it preferable to the arc.

An example of the second type of floodlight mentioned above is the Airport Floodlight of the Pittsburgh Reflector Company. (See Fig. 4.) The following are its outstanding features:

(1) The paraboloid reflector is pure silver, on crystal glass. The silver is electro-plated with copper, which hermetically seals it from the atmosphere. The mirror backing is guaranteed for 10 years not to discolor, crack, check or peel.

Fig. 4. Side view of floodlight of the Pittsburgh Reflector Company. This lamp has a dioptric lens and a silver paraboloid reflector.



(2) The 1,500 watt general service lamp is used; this lamp is available in lamp stocks. Special floodlight lamps are hard to procure, as they usually must be obtained on a special order from the factory, which takes time. The first cost of the general service lamp is low, while a special lamp may cost 100 per cent more. The rated life of a general service lamp is longer by 25 per cent. For the large airports, the 25,000 lumens, 20 ampere, PS-52 clear type C lamp, such as is used for street lighting, should be employed. This lamp has 35 per cent longer rated life than the general service lamp, but its greatest advantage is that it is operated on a series circuit, which reduces to a minimum the cable cost and losses; as in the street lighting circuits, the constant current transformer must be used.

(3) The dioptric lens is scientifically designed to spread the beam horizontally and also to depress the rays, which would otherwise go above the horizontal, into the main beam. This heat-resisting glass lens is cemented into a frame (the hinged cover ring) with a waterproof compound which remains soft indefinitely.

(4) The housing is water-tight and non-ventilated; there is no circulation of outside air through the floodlight to draw in moisture and dirt; therefore it is kept clean and efficient.

(5) Focusing is done from the outside of the housing, so that the floodlights may be burning while the desired results are being obtained by making the necessary adjustments. Elevation and azimuth pointings are designed for easy operation. All screws, bolts, etc., are of brass; in other words, parts in contact are of dissimilar metals, to prevent sticking due to corrosion.

(6) All cast parts are of iron, to resist rusting and decomposition by chemical or salt laden air. The drum is drawn of one piece and coated inside and outside with zinc, after being formed. Only copper rivets are used.

With an increase in night traffic, signal lights for communication between the airport manager and airplanes are necessary.

A ceiling projector is a narrow beam floodlight, elevated at an angle of 45 degrees, to determine the height of clouds, fog or mist layers, at an airport. A 12 in. incandescent searchlight, with a 250 watt lamp and grey light shield may be used. The ceiling height is determined by measuring the distance from the projector to a point directly under the light spot appearing on the clouds or fog, as in Fig. 5.

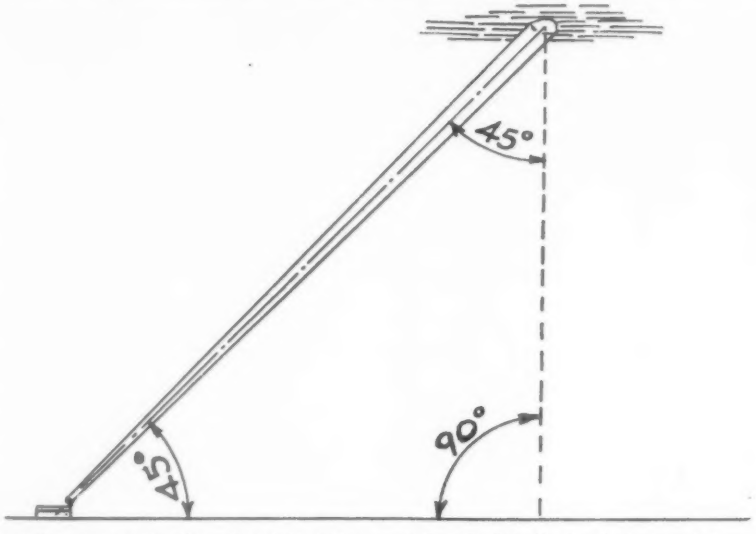
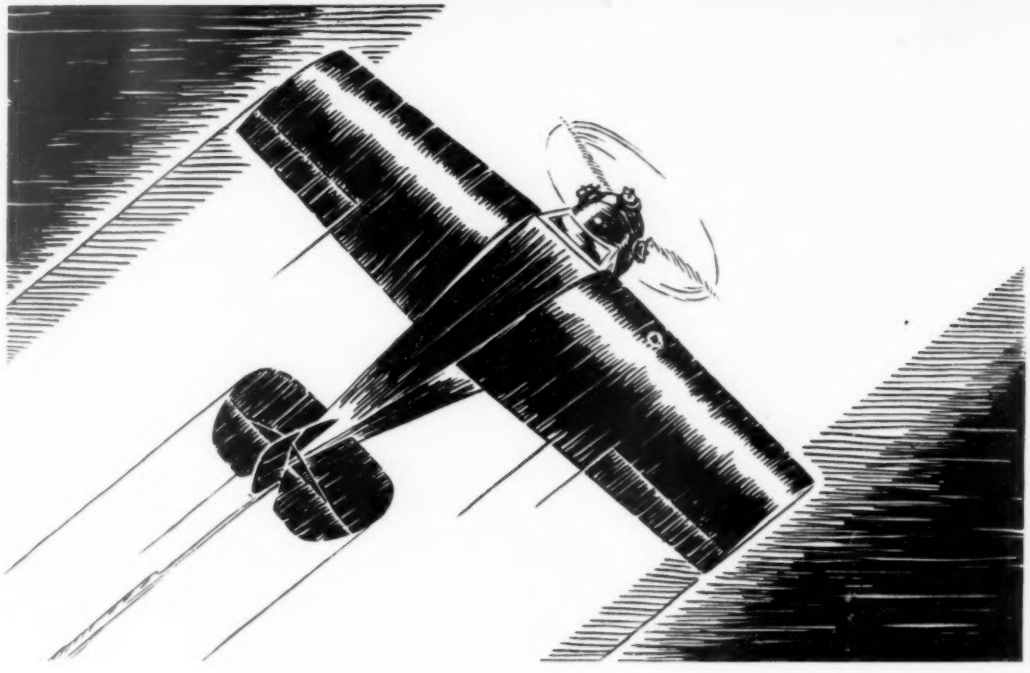


Fig. 5. Method of determining the altitude of cloud-layers with a ceiling-projector.

The floodlighting of the buildings in an airport is of great importance. The vertical walls of hangars and other buildings should be illuminated to an intensity of 2.5 foot-candles. This is best done by floodlights. The most efficient floodlights for this purpose are those with reflectors, which in effect almost surround the lamp, and which are made of glass, backed with silver. The reflector shape referred to controls at least 50 per cent more light flux than the shallow reflector set at the back of some floodlights. Silver plated glass has a co-

(*Continued on page* 109)



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"It DOES Make a Difference Who Instructs You!"

"Pre-War Stuff"

By Bertram W. Williams

FOR some reason the aviator—the "intrepid aviator" as the press termed him—was always taken more seriously in Europe in the pre-war days than he was over here in the land where human flight was first proved possible. In England, France and Germany he was a public hero, little short of a demigod. Here in the States, people looked upon him as a kind of glorified circus clown with more nerve than brain.

Now, ever since I was a boy, I had wanted to be a hero. Not the kind where you "did your duty" and were rewarded with the hand of the heroine, but the sort who got pointed out in public places, at whom people stared and whispered, "That's him!" A popular idol who received a salary for doing daring deeds—that was my real rôle, I felt sure.

True, the novelty of flying had worn off a good deal with the public. They had come to accept aviation as an actual fact. But the daring soul who piloted a plane outside of an aerodrome was still a person ranking above ordinary mortals in popular esteem.

Six months after first seeing an aeroplane in actual flight I was in London, and the second day of my arrival there found me hovering outside the great flying field of Hendon where there were several schools of aviation. Somewhat timidly I entered the gate—paying a shilling for that privilege—and stared around. It wasn't so impressive as I had imagined. A few planes were droning monotonously round and round less than a hundred feet high, and occasionally a small group of men in greasy overalls would come out of one of the big hangars to watch them. When a machine landed, it was instantly dragged inside its shed to be inspected for damages. I found out later that very few pupils ever did land without breaking a wire or shaking loose a bolt or something. The planes of those days were not very strongly constructed, neither were the landing fields particularly smooth. Also, if being an "aviator" gave one a certain amount of prestige with the man in the street, it meant absolutely nothing to the real pilots and mechanics in the aerodrome. A student flyer was looked upon as a nuisance. Of course they had to let him take a machine out now and then; but woe betide him if he cracked it up. Parachute packs and safety belts were unknown. If a pupil and his bus parted company in the air—which really did happen sometimes—a small crowd of anxious-eyed men would dart from the hangars to first inspect the wreck. Afterwards, if one of them happened to think of it, they might stroll over to see what was left of the human element. A thing of scorn was he who crashed a plane. This was a somewhat drastic attitude, perhaps, but it weeded out both the timid and the reckless. For in spite of low wages and the comparative cheapness of materials, aeroplanes and aerial motors were proportionately far more expensive than they are now.

Of course, on the voyage to England I had read a great deal about flying and had assimilated a vocabulary of new and strange words, most of them quite Frenchified. In my first half-hour at Hendon I was thus enabled to pick out the different types, although I didn't know any advantage one had over another. They all seemed to make a great deal of noise and to hurtle through the air much faster than was pleasant.

The editor would be grateful for the address of Mr. Williams, the author of this interesting story of early training. Mr. Williams, or friends of his, knowing his address, please write.

I liked the look of the Caudron biplanes; they had pretty blue wings and a little canoe-shaped structure where the pilot sat amid a maze of struts and wires. The Farman "box-kites" did not seem so good to me. They were dual instruction machines with the pupil squatting in an open seat below the instructor and a great big engine perched overhead ready to give both a nasty poke in the back in the event of a bad landing.

Then there were the monoplanes. There were the long-bodied Deperdussins with their square-cut brown wings, and the trim little Bleriots, the same type in which their inventor had first flown the English Channel. They attracted the eye, but I remembered having heard that monoplanes were much more difficult to fly than biplanes.

I was standing in doubt when a young fellow in a leather helmet came over to me. People in England don't as a rule address perfect strangers unless they are drowning or their house is on fire. So I was quite flattered when this chap showed an interest in me. I told him I was thinking of learning the flying game and had half decided to enroll in the school that specialized in Caudrons.

He laughed scornfully. "A biplane! What does a biplane pilot amount to?"

I couldn't tell him.

"Now if one can fly a monoplane," he went on, "one can fly anything. The army's crazy to get monoplane pilots."

"But isn't the other kind easier?" I asked timidly.

"Aw, any fool can take one of those box-kites around. Better join our school. I'll introduce you to the instructor."

The latter gentleman proved to be a rather supercilious young man wearing razor-edged trousers. He was sparse with his conversation, yet somehow he managed to convey the impression that he was doing me a favor in accepting my check.

The standard fee in England at that time was seventy-five pounds, $375 in our money, according to the then prevailing rate of exchange, but in reality more like $1,000. In Germany the fee was higher and there were clauses about responsibility for breakages. All the European schools, however, guaranteed that each pupil should be given instruction till he passed the tests laid down by the Federale National Aeronautique of France which entitled him to an aviator's brevet or certificate. These tests would appear almost childish nowadays, but on the flimsy machines then in vogue they were far from simple of accomplishment. Only two flights (solo) were

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required at an altitude of not less than fifty meters, each flight to consist of five figures of eight 'round a given course, when a landing had to be made with motor cut off within ten meters of a designated spot. The landing was less easy than the flight, as a pupil would usually misjudge his distance or forget to switch off his engine as soon as he touched the ground.

Once I had signed his long and vaguely-worded contract my new teacher seemed to lose all interest in me. He answered my questions with curt brevity, and after recommending me to buy myself a suit of cotton overalls, excused himself.

Much to my disgust I found that overalls and ordinary caps worn reversed (the latter, not the former) were considered all that was necessary for a student flyer to wear. To have worn a leather suit and helmet such as I had wished to get would only have caused ribald remarks. Even goggles were taboo. You might get a gob of castor oil in each eye during flight, but what of it? It was the custom of the country. Most of the pupils were British army officers who during leave of absence were paying for their own tuition. They were a cliquey lot with a great disdain for mere civilians. Even the French mechanics and instructors appeared to share that prejudice—a shadow of the war to come.

The author in the Bleriot monoplane in which he learned to fly at Hendon.

Actual flying instruction in those days consisted of visiting the aerodrome before sunrise, where if there was no wind, a battered plane with a 25 h.p. Anzani engine was wheeled out of its shed. The ignition was retarded on the latter so that there was no possibility of the machine leaving the ground. When your turn came, you climbed into the oil-spattered cockpit, a mechanic swung the propeller, and you were left to your own devices. Fortunately the field was big and there was plenty of room to go rolling about in it. Rolling about, that was all one could do. A Bleriot monoplane had caster wheels which swung in all directions, making it impossible to steer a straight course unless top speed was attained.

Round and round one would go like a dog chasing its tail. There were two of these ancient crates to play with, but they were both so decrepit that the least rough spot on the field would upset their internal economy. Bolts were continually working loose, wires snapping, or their fan-shaped air-cooled engines going wrong. I didn't know much about motors in those days, but I am now firmly convinced that neither of those Anzanis gave more than five or six brake horse power. As we were never permitted to take a machine out when there was the faintest breath of air stirring, our wings did not sprout very fast. The one aim of our instructor was to get the planes back into the hangar undamaged. He would then fill the tank of his car with the school gasoline and motor airily homewards.

Although there was seldom anything but jealousy among the pupils themselves, a common grievance drew us together. After all, we had paid our money to learn flying, not to ride on a freak-wheeled contrivance that splashed oil all over us. The result was that I composed a letter which we all signed and sent to the great Bleriot himself at his Paris home.

Instead of sending the usual promises and regrets, that distinguished pioneer came over to England immediately to personally investigate the manner in which his London school was being conducted. No one had ever seen our original instructor—he of the creased pants—fly; but he certainly "got the air" when his employer visited Hendon. A young Frenchman was appointed in his place, a man who did not think it beneath his dignity to give a pupil the benefit of his own experience. Also, and what was even better, a new Penguin was placed at our disposal. This was an ordinary Bleriot plane having a more powerful engine, but with wings cut down so that they could not lift the machine off the ground more than a few inches. One was thus able to get up enough speed to steer the machine much the same as though it were in the air. The confidence thus gained was invaluable. A few runs across the field and I was ready for the next stage, a 28 h.p. engined machine that actually flew. By tugging violently at the *cloche*, one could lift the plane ten or twelve feet in the air and skim proudly across the drome. The control-lever or *cloche*, it must be explained, differed from the usual joystick in having a small fixed wheel on top in the center of which was set the magneto switch. Usually a pupil finding himself leaving dear old Mother Earth would hurriedly cut off the ignition and plop heavily downwards. It was more than funny to see some embryo pilot go bounding across the field like a scared kangaroo.

I soon got quite at home on this machine. Too much so, for I became firmly convinced that my ceiling was about ten feet! Jules was beginning to give me sour looks, which changed to harsh-sounding words in French when one day I crashed the "28" into a fence. However, I somehow convinced him that it was only my high spirits and that I was past the diaper stage of aeronautics, anyhow, and ready for the special "brevet bus."

This machine was a real he-pilot affair. Its 35 h.p. motor was quite new, certainly not more than five years old; and the wings were fairly well lined up with no more than a four-inch list on one. It was wheeled ceremoniously from its hangar one morning, and I clambered in, looking,

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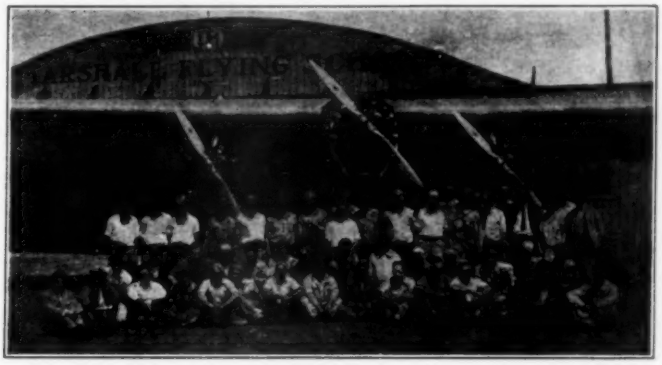

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I hope, a whole lot more confident than I felt. After being warned by the instructor that she was "veree power-ful," I switched on and was off. We didn't know anything about chocking the wheels at that period. There was plenty of room, and as long as one could dodge the cattle and sheep which dotted the aerodrome, one would eventually leave the ground.

Contrary to my expectation, I found the increased power made the machine quite easy to handle. After a few straights at my usual ceiling, I set my teeth, pulled firmly back on the stick, and found myself flying slowly round the aerodrome at the stupendous height of 200 feet. Circles and figures of eight followed without difficulty, though I was careful never to bank my slow-moving bus. I never experienced the least nervousness in landing. Of course, some of my descents were rather bumpy and I never gained enough confidence to come down with the motor fully cut off. In those days a volplane was considered quite a feat and not encouraged among pupils. Several oldtimers commented on the remarkably steep angle of my landings; but it was not till many months later that I learned this was the result of keeping the stick rigidly fixed in the position I had pushed it into to descend. No one had ever told me to return it to neutral once the bus had started down. Imagine what would happen on a horizontal plane if, when you rounded a corner in your automobile, you locked the wheel!

My first brevet test came off all right, though I landed much further away than was prescribed in the rules. In the early stages of solo flight one is apt to concentrate so intensely on the handling of the machine that one has no room for any vagrant thoughts. The arithmetical problem of counting five—the number of "eights" required in each test—was too much for me. On my second brevet flight I lost count entirely about the third round. After that I didn't know whether I was on my seventh or merely the fourth till I noticed a little knot of men in the field below excitedly waving to me. I was badly worried, thinking the under-carriage had dropped off or that something equally disastrous had happened. Then it struck me that they were merely encouraging me to keep on going. With an effort I dismissed them from my thoughts. A little later I took another peek over the side. The fools were now dancing about in their excitement. Did they think I couldn't fly? I'd show 'em. When I actually did descend I was still a little doubtful whether my quota was complete; yet they told me they had tallied up to thirteen and then given up the count, and a fellow-pupil even hinted that I was afraid to come down!

Yes, learning to fly in the early days was a catch-as-catch-can proposition. The machines were underpowered rattletraps that had been cracked up and patched together a dozen times. The aerodromes were surrounded by tall pylons waiting to be bumped into, and the air was often crowded with a dozen planes flying erratically in all three dimensions of space. Still air? Not so you could notice it. The cross-currents caused by the backwash of all this aerial traffic were fierce and very unsympathetic with our feeble crates. To enhance the pleasures of landing and taking off, live stock grazed unconcernedly all over the field.

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Hendon was a popular resort at that time. Celebrated French and German flyers would cross over from their respective countries and land there. Weird-looking machines were tested by the pilots and criticised by the groundlings. Races were held every Sunday which the highest in the land came to see. An aviator was still a person of consequence no matter what his former station in life had been. When Pegoud first looped the loop in a Bleriot monoplane, London went crazy. People were excited, not because it was a spectacular stunt, but because it was taken as a proof that an aeroplane was really a safer contrivance than a motor car—in competent hands.

Some of England's most aristocratic daughters paid fabulous sums to be taken up and "looped." When Gustav Hamel, the foremost British pilot, was reported missing in a cross-channel flight, the Admiralty sent a fleet of destroyers to try and locate him. Winston Churchill, secretary for the navy, was a constant flyer. As for the Anglo-French *entente*, whether it was a result or a cause of this mutual aerial activity, there is no doubt that the adulation which was showered in England on all the famous French pilots of that day had a lot to do with cementing it.

I was up 16,000 feet in a navy plane not long since, and on the trip down the pilot put his machine through many strange evolutions. Yet somehow I did not get the thrill I had in that ancient monoplane with which I made my first flight fifteen years ago.

Curtiss Flying Service

Information of general interest was contained in a statement to the stockholders of the Curtiss Flying Service, made recently by C. M. Keys, chairman of the board of directors. Mr. Keys outlined the plan of operations which the $6,750,000 flying service expects to complete during 1929. Five fields are already in operation and in the early spring, according to Mr. Keys, eleven operating centers are to be established at eleven large cities.

Arrangements are being made in seven other cities for the inauguration of flying services, and it is expected that these negotiations will be satisfactorily concluded in time for the opening of the flying bases in the late spring or early summer. Establishment of similar services at six other points will put a total of twenty-nine Curtiss units at the disposal of the public.

Complete aerial service will be made available at these twenty-nine bases. Besides the sales organization, which will distribute Robins, Fledglings and Sikorsky amphibians, the Curtiss Flying Service will provide full facilities for the repair and maintenance of all types of aircraft. Servicing of planes and motors, periodical checking, and complete take-down and overhaul are among the tasks performed by the Curtiss organization.

One of the most important functions of the service will be that of providing flight instruction. One hundred and fifty new training planes, identical with the standard training ships used by the U. S. Navy, have already been ordered from the Curtiss Aeroplane and Motor Company for delivery to the Curtiss Flying Service within the next six months. The schools will use these planes. In addition, crop

(*Continued on page* 118)

Richard Arlen in "Wings," Courtesy Paramount Pictures.

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Sailplane Construction

Fig. 6. A sailplane shortly after the start. Note the split formation organ between the transversal rudder and the supporting wings, which in spite of its simple construction, had best be avoided to lessen resistance.

By Alfried Gymnich

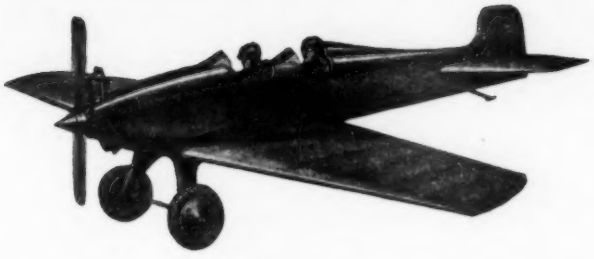
Translated by John H. D. Blanke

(Continued from the December Issue, Installment V)

THE connection between the rudder and the control levers is apparent from the schematic representations in Figs. 1 and 2, whereas Figs. 3, 4 and 5 show the arrangements of the control organs, which are in principle the same as in a motored airplane.

The elastic distortion of the rudders, based upon the example given by nature, does not appear likely to introduce itself, even though flap-like rudders effect a greater development of whirl and therewith greater detrimental resistance than does elastic distortion with its harmonious transfers. The reason for this is found in the field of construction, for a wing that can be distorted, and which at the same time possesses sufficient strength, requires an especially careful assembly. Besides, the increase in the detrimental resistance which arises from the use of flaps is practically negligible, and of very little consequence under skilful design and placement of the rudders. Preferably very narrow rudders of great span are used, for these permit a maximum efficiency with minimum resistance. The transversal rudders are frequently placed at an incline; that is, they run towards the fuselage in a sharp angle in order to prevent a split formation and the accompanying detrimental whirls. The attachment must furthermore be managed in such a way that no split effect develops between supporting surface and rudders, or between fins and rudders. A design like that illustrated in Fig. 6 is therefore poor and should be used if at all only for the simplest of schooling sailplanes. Figs. 7 and 8 show placings of rudders which are more satisfactory.

After this briefly general introduction into the elements of the sailplane and of sailplane construction and before turning to the practical development of a schooling sailplane, we must still discuss the chassis. The chassis is by no means only an aid for starting and landing, as is frequently assumed, but it must be connected organically with the plane and suitably designed; for the more easily a start can be made, the more likely are breakdowns to be avoided. It is generally customary today to use the bent central runner with or without some elasticity, for it combines minimum weight with simple construction and minimum air resistance. The danger that the plane with a central runner may tip down upon one wing at a low starting or landing speed can be said to scarcely exist at all, for with sufficiently large transversal rudders it is possible to hold the machine in balance even when it is standing still. Special surfaces or wing protecting



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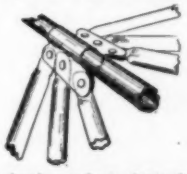

Note the simple method of hinging the elevators. The front elevator beam is a steel tube. Simple metal straps slip around this beam with the ends bolted to the rear stabilizer spar.

The main wing beams are of box-type, made of two small beams of spruce covered with plywood as shown below. This type is simple and widely used.

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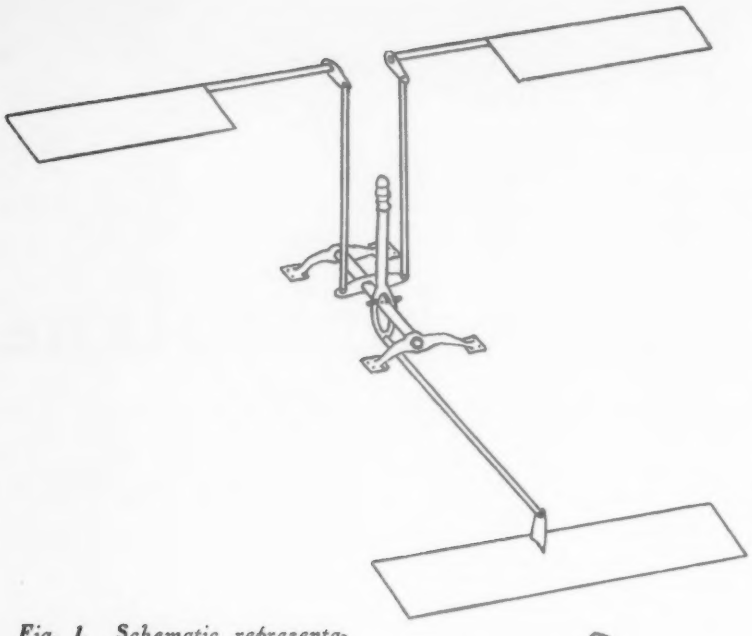


Fig. 1. Schematic representation of the altitude and transversal controls by means of push rods and angle levers.

arches are therefore seldom used any longer. Besides a lower air resistance, the single runner design has, as compared with the double runner design, the advantage that in landing in a cross wind the chassis, and with it the entire machine, is less endangered, inasmuch as a machine with a central runner turns itself more easily, indeed almost automatically, against the wind. In spite of this, one still sees now and then a sailplane with two rigid runners which are connected with each other (the so-called sled chassis), because by this means the start is made easier for the beginner, and through the broader runner base an easier installation of the seat and of the control stick is possible. These advantages, however, do not in any way compensate for the disadvantages.

If we study the following drawings, it becomes immediately apparent why rigid and straight runners make the start more difficult. We assume that the angle of approach of the wings is 0 degree. The starting crew begins to pull and the pilot manipulates the altitude control in order to give to the wings the angle of approach required for effecting the ascent. In this method we proceed on the supposition that the pressure upon the altitude rudder, caused by the starting speed, is sufficient to permit a tipping up and an increase in the angle of approach caused thereby, for otherwise a start would be impossible. At the same moment when this occurs, however, the airplane is deprived of its supporting surface, for the entire weight rests now upon the end of the beam plowing upon the ground. The friction on the ground increases enormously, the starting speed decreases and the machine does not rise off the ground.

Fig. 3. The most usual arrangement of the control lever for sailplanes. The cable coming from the altitude control leads to the control stick, then over a return pulley back to the altitude control. The cables leading to the transversal rudders are located on a double lever, which is connected rigidly with the horizontally placed pipe.

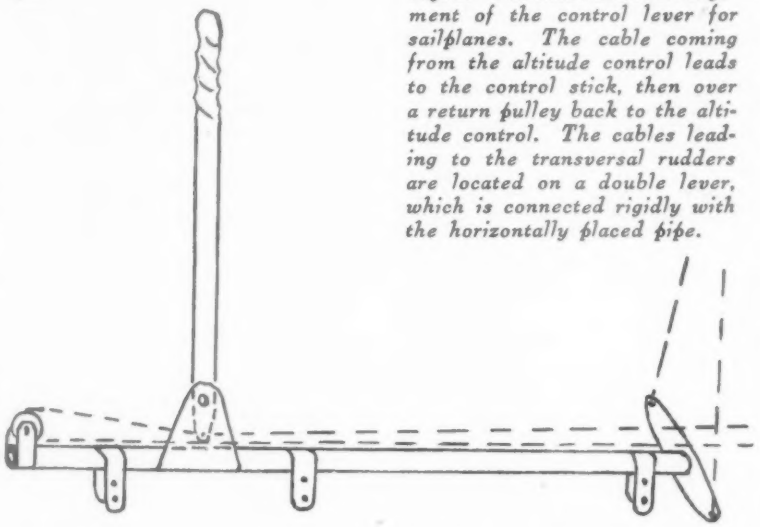
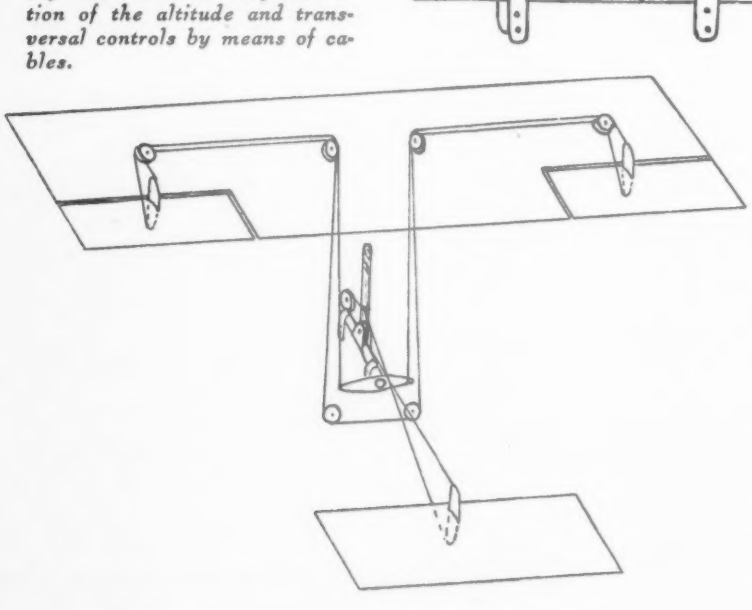


Fig. 2. Schematic representation of the altitude and transversal controls by means of cables.



Somewhat better, though not to be recommended, is the second arrangement. In this construction the supporting wing is given arbitrarily the angle of approach re-

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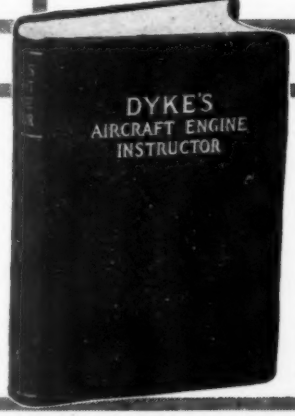

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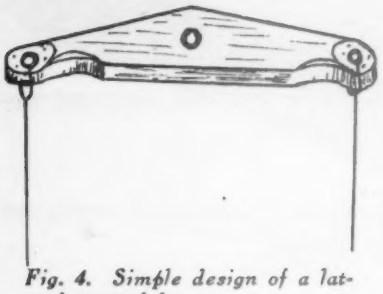

Fig. 4. Simple design of a lateral control lever.

quired for the start. This arrangement permits a rise from the ground, of course, but the moment when the plane rises depends entirely upon the pull of the starting crew and upon the strength of the wind. The pilot obtains power over the longitudinal direction of the machine only after it is in the air,

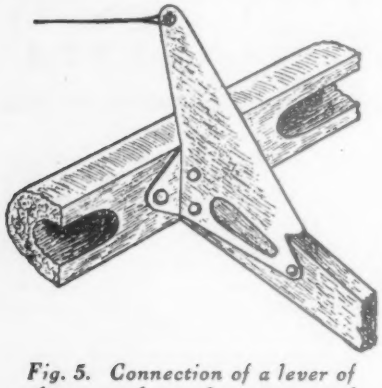

Fig. 5. Connection of a lever of sheet steel to the transversal rudder.

and this delay can also lead to misstarts and accidents.

The chassis must be designed, therefore, in such a way that the largest possible ability for control is acquired while still on the ground. This is the case when the runner is located vertically to the direction of gravity in any position of the plane, which would call for a circular design of the runner. In order to minimize somewhat the undesirable tipping motion resulting thereby, which would require a continual manipulation of the altitude control, the runner is designed parabolically, especially since a circular-shaped runner would push itself more into the ground and thereby increase the friction. A parabolically arched runner with a free elastic rear end, is shown in the third design in Fig. 11 and is also apparent in Fig. 12. Still better becomes the action of such a runner, which can be considered today as standard, when an elastic arrangement is provided between the runner and the fuselage (rubber cable, air bag or spiral springs), but such mechanisms naturally always increase the cost and complicate the construction of a sailplane. It is sufficient, if the shock in landing is dampened through good upholstering in the seat, to leave the plane unburdened with a shock absorbing device.

In the construction of the runner one must naturally take special care that the shock of normal landing can be absorbed in such a way that a uniform transmission of the forces

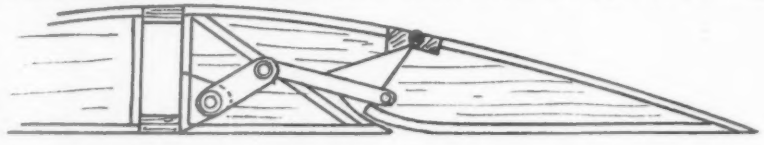

Fig. 7. Method of attaching a transversal rudder so that an open split is avoided.

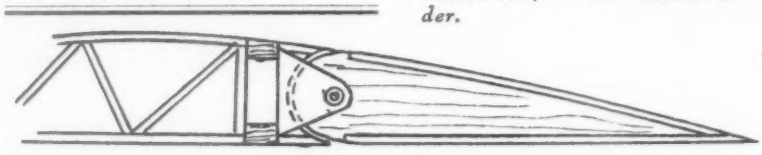

Fig. 8. Another satisfactory attachment of the transversal rudder.

to the individual joints takes place. The runner leaf itself should be wide enough to avoid pressing down into the ground. A width of about 3 inches is practical, even though the width depends always upon the weight of the plane and upon the starting grounds. The start in dune country, for example, requires a

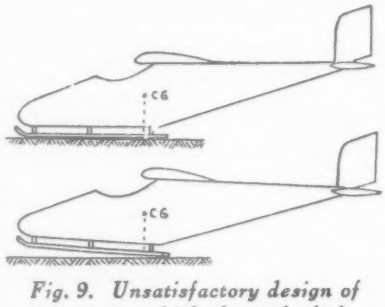

Fig. 9. Unsatisfactory design of runner, in which the end of the runner plows the ground in starting and acts as a brake. The pilot obtains control over the machine only after it is in the air. (C G is center of gravity.)

wider covering surface than the start from the grass sod.

For constructing the runner, ash wood comes into consideration. The strong runner leaves are bent, after they have been placed for a few days in cold, or for a few hours in hot water. Forcible screwing in without previously making the wood pliable, may result in the case of severe landings in a tearing off of the runner leaf. The fastening to the floor of the fuselage is usually accomplished with the aid of a large vertical board which has the shape of the runner and the floor of the fuselage and fits into the cut-out of the frames provided for it, and is glued in. The lateral reenforcing is done, as everywhere in sailplane construction, by means of corner ledges or corner blocks and plywood covering.

In the case of sailplanes without an actual fuselage, and therefore, especially in the case of the so-called seat gliders, the vertical runner supporting board is naturally elimi-

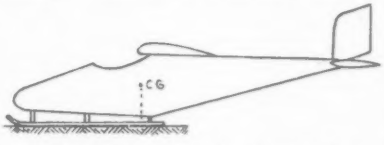

Fig. 10. A somewhat better design. The braking moment at the start is avoided, but also here a control in longitudinal direction is secured only after leaving the ground.

nated. Here the fastening of an arched central runner can take place only on a so-called "blind" runner, since for the static design an arched runner can naturally not be used. Also practical is the construction of a bent runner of several thin leaves which are glued individually upon the supporting board of the runner or bent over a pattern and glued together. In this method the non-supporting or free-carrying ends are arranged in steps in order to attain a better elastic effect; that is, the lower leaf is the longest. In order to prevent the runner catching cross-wise when landing in side winds, the lower cross section of the

runner is arched and the edges are rounded.

The wheel chassis, as it is used in the construction of motored planes, has not been able to hold its ground in the building of sail planes,

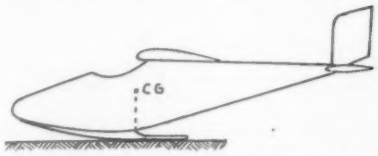

Fig. 11. Satisfactory design of runner, with free-carrying or non-supporting rear end. The parabolic form of the runner gives control of the plane in a longitudinal direction while still on the ground.

since besides adding resistance, it increases the chance of breakage in landing on sloping ground.

An intermediate method between the runner and the wheel chassis, the use of roller balls, may be mentioned briefly. The rollers or roller balls have the shape of footballs and contain a rubber hose with a valve fitted to the shape of the leather bag. In this arrangement, which must be acknowledged to be an ideal solution of the problem, there is combined minimum air resistance with minimum friction on the ground and a good elastic action. The price for such elastic balls, which are a special product, is naturally not low.

In the next installment we will begin the building of a simple schooling sailplane.

The Symbolical Cover

From the many requests coming into the office of POPULAR AVIATION it seems that an error of omission was made when we neglected to publish a brief note about the beautiful symbolical cover that appeared on the December number.

Surmounted by an eagle, emblematic of our national aviation, is the huge winged figure denoting man's age-long aspiration to fly, dominating the entire design. In the center is the Wright Brothers' original plane, the first to fly. Above are the modern developments of land and sea planes.

About the feet of the giant figure have sprung up the activities of present day aviation, with the three key men—the Engineer, the Pilot and the Mechanic. To right and left of them are the tools of their trades, theory on the left and practice on the right.

Should any of our readers desire copies of this cover we will be pleased to send them on receipt of five cents, to cover the postage and packing. The size and coloring are exactly as on the cover of the December number.

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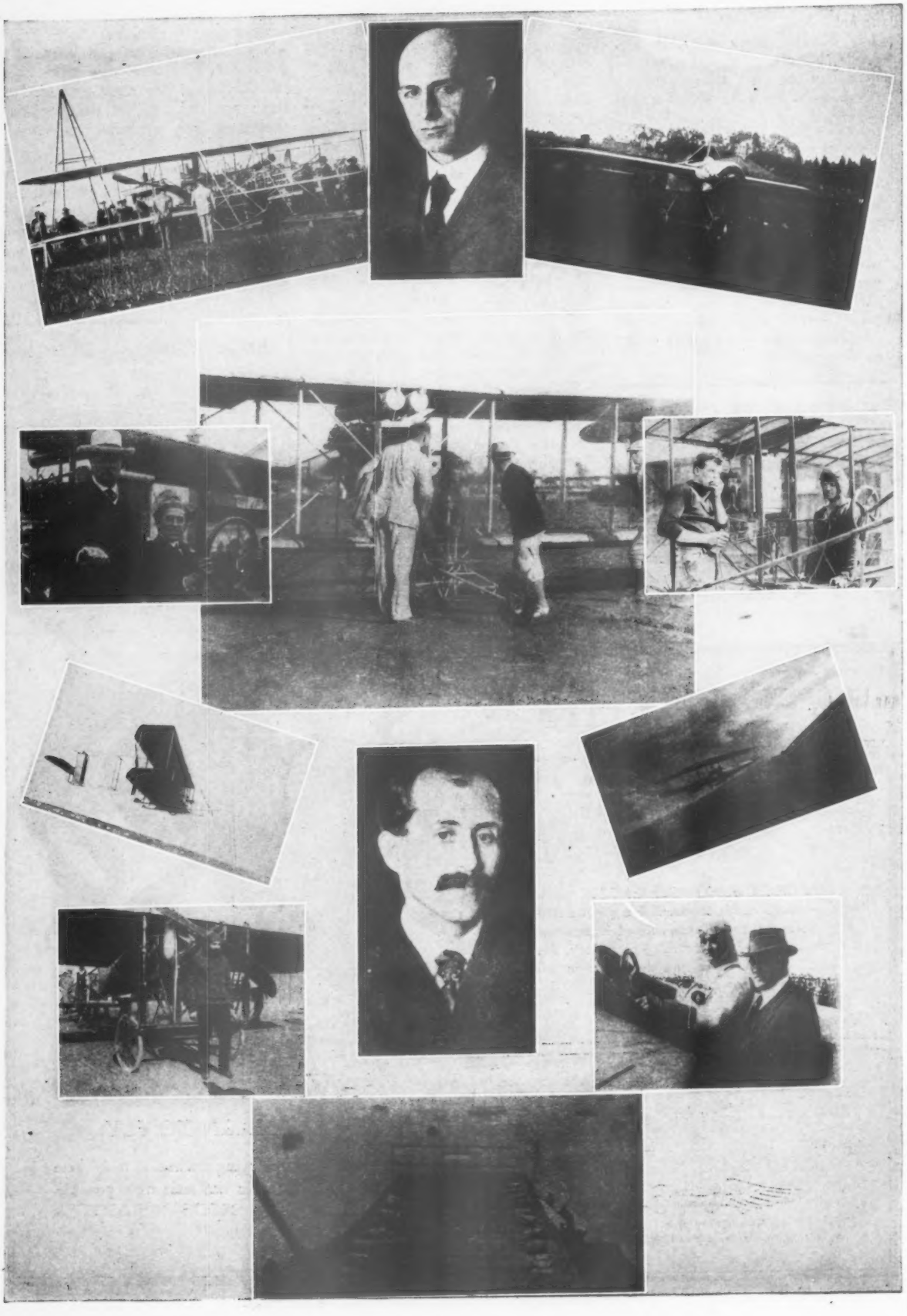


Old Timers—and Others

THERE was a time when albums were as important a fixture in every well-ordered home as radios are today. Samplers made by grandmother when she was a little girl looked stiffly down from the wall. There were charcoal portraits, and sea shells, and ornamental arrangements of human hair kept in glass cases. But the world marches on, and preserved curls, and conch shells, and smudged drawings, and samplers have all been banished from the parlor to a glorious exile in antique shops; even albums are no longer displayed openly, though the rites of picture mounting are still carried on clandestinely. Nevertheless, whether fashionable or not, old snapshots and photographs continue to fascinate on occasion even the smartest people. Only a very strong man can resist the impulse to look through a stereoscope if given the chance, notwithstanding the fact that the pictures featured in such an entertainment are generally ancient to the point of decay.

It is without apology, therefore, that POPULAR AVIATION invites its readers to participate in solving the mysteries presented on the opposite page. Aviation is sometimes thought of as too young to have even a minimum in the way of past. Such a stigma is very readily removed by evidence of the type presented herewith. How many people can identify more than two or three of the photographs reproduced?

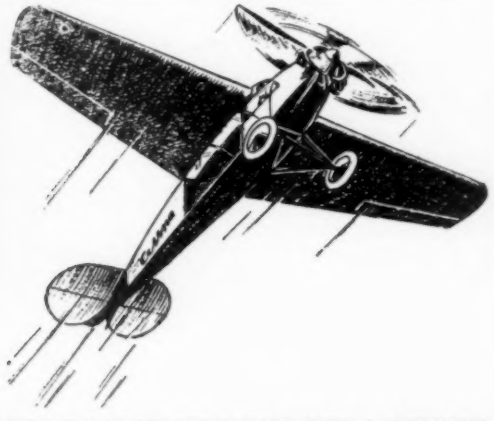
Barring certain of the old timers who have lately been in our office, we doubt if many can give full and accurate descriptions of the dozen pictures shown. So for that reason we are offering a prize, under the following conditions:

For the best identification and description of the photographs shown on page 86, we will award a fine $100.00 wrist watch. The only other condition is that these descriptions be in our hands before February 1st. No one is barred, you do not have to be a subscriber to the magazine, simply being a reader is sufficient. But we do suggest that you follow the old newspaper maxim of "Who, what, where, when and why."

We may be surprised at the number of accurate identifications received, for the memory of some of the early birds is simply astounding. We had a visit the other day from an old army man whose particular hobby is old-time photographs and he seemed to know the time, place and people of every photograph we showed him, no matter what the source. Then he would go on and name some of the spectators showing in the pictures and start a full and complete series of anecdotes relating to the flight in question.

However, you do not have to be one of those old timers in order to try for this award. Many of the photographs are well known, and need little identification. A mere identification will not win over an accurate description of the planes, engines, persons shown, and the circumstances under which the photographs were taken.

WIN WITH A WINNER



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Woman's Influence on Aviation

By Margery Brown

FLYERS do not like the idea of women invading the flying fields with their vanities and conceits. They would much prefer to have women leave aviation strictly alone. But this is a vain hope. Women influence all activities. They are responsible for the easy-driving, no-care automobiles, for the closed car, for the light car; and they will inevitably have an influence on aviation, from the private flying standpoint.

As far as equipment, color combinations and upholstery are concerned, women are influencing aviation right now. Many a man who is considering buying a plane, is listening to what his wife has to say, just as he listens to what she has to say when he buys an automobile.

A man whom I know recently received delivery on a plane, the color combination of which proved to be most unusual; so much so that it aroused considerable comment, not all of a favorable nature. I rather liked the effect. The first time I saw it, I exclaimed, "I'll bet a woman chose those colors!"

So it proved. A woman had indeed selected the color combination. Had he not taken a woman's advice, he probably would have purchased the ship in stock colors.

This is only one instance. No doubt there are dozens.

Many a woman will be saying petulantly, "If you get an open cockpit, I'll refuse to fly with you!" . . . or, "For goodness' sake, if you're going to buy a plane, get one of a distinctive make or color! Who wants an airplane that looks like every other old ship on the field?"

Just now, it is mainly through men that women are influencing aviation, yet the time is coming when women pilots will be nearly as common as women automobile drivers are, now. But women will demand safety and comfort above everything else. A woman will want to fly to a luncheon thinking about last night's bridge score; she'll want to fly to the country club while planning a new frock. The plane will be expected to do most of its own flying; likewise most of its own thinking. On certain occasions she'll expect the plane to fly itself, while she gossips with her flying companion. At the present time, this type of flying cannot be done with any degree of safety at all. Quite the contrary!

Men flyers are aware of this feminine tendency, and they know how much alertness, perseverance, patience and stamina have been required of them. Can one really wonder that they are annoyed when the fair sex regard flying so lightly?

One woman of the leisured class who is learning to fly, gave it as her opinion that flying will not be very common among women for some time to come, because of the uncertainty of weather conditions. One might fly forty miles to a luncheon or a golf match, then suddenly the weather would change and rain begin to pour. To return would be impossible. One might conceivably miss a dinner engagement or a dance under these circumstances; or else be forced to return by motor, and leave the plane to be ferried back when the weather cleared.

The average woman who is thinking about taking up flying as a sport, thinks of it in just this way, and it is this superficial attitude that riles the seasoned pilot, who perhaps flies through rain, snow, storm and wind four days a week, getting the mail through. The idea of such a horrible thing occurring as a dinner engagement missed, because of weather conditions and the limitations of a plane, makes him snort with rage. Weather or no weather, he risks his neck and sticks to his job, but he isn't doing it because he is eager to attend a costume ball or a literary tea!

Yet, women of this type are the ones who have the money to spend. Those of their sex who take flying seriously, can't often afford it. Leisured women have the means; they are bored; they are looking for a thrill; and they are used to getting their own way. They go right ahead insisting that conditions be rearranged to suit themselves, and what they want, they get. So, when they demand the safe, easy-flying plane, they will get that, too; not immediately, of course, but eventually.

Likewise they will demand an aesthetic appeal in their planes. An interior of snakeskin to match her shoes and handbag, will sell an airplane to a woman much quicker than an improved type of motor will sell it. Manufacturers will begin to cater to this feminine taste. And of course safety devices of various kinds will gradually eliminate risk.

That airplanes should become as safe as possible, is right. That they should become a mere adjunct to vanity and shallow amusement, seems regrettable. When the day comes that airplanes dot the sky in droves, solely on pleasure bent, then I, for one, want to fly no more; or else to fly to "the uttermost parts of the sea," where the hush and quietude of unpeopled space are broken only by the rhythmical and soothing sound of the motor. It seems a sacrilege that anyone should fly in the same spirit that he pursues amusement on the ground. It is like taking a jazz band into a cathedral.

But, there is no stemming the tide. Easy-flying, no-care airplanes are on the way, and eventually all will fly them. What is made easy enough for the indolent woman, is easy enough for anybody. I do not want to see the skies crowded with flying "Lizzies", with rollicking picnickers who throw banana peels and greasy paper bags on the housetops! Will it ever come to that? Do the majesty and peace of space have no appeal for the human race? But, the sky is boundless. Perhaps there will be room enough for all; for those who want to fly in solitude, and for those who want to fly in masses.

It may be an injustice to women to assume that the majority of them regard flying with so little seriousness. Possibly they do not want to carry millinery bills and other mundane concerns into the placid summer skies. I hope not. Spontaneity and joyousness enough are there. Let them turn their gaze upward, for a change; outward, in-

(*Continued on page* 109)

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Toronto Flying Club

By Eric McLeod Fowler

FIFTEEN pilots trained for commercial licenses, twenty more doing solo flying, and a record of nearly one thousand hours of flight without a washout or even a serious crack-up, is the enviable history of the Toronto Flying Club for its comparatively short existence.

Organized in the late spring of 1928, the club came into being as the result of two mass meetings of war-time aviators. The meetings were held because a former chief of staff of the Department of National Defense, Major-General J. H. MacBrien, had been going up and down the length and breadth of the country at his personal expense preaching the gospel of "air-mindedness." For months he had waged an almost single-handed campaign to awaken Canadians to the possibilities of civilian flying.

The formation of the Canadian Aeronautical Association was largely due to his efforts and from this organization grew the string of civilian flying clubs which now exists all the way from Halifax on the Atlantic to Vancouver and Victoria on the Pacific Ocean. The Aeronautical Association is the parent body for all the flying clubs. Each member of a local club must purchase ten one dollar shares in the national body, to which is added the annual dues of the flying club. Thus the stock in the association is in the nature of an initiation fee and is not paid after the first year.

Recognizing the desirability of building up a pilot reserve during times of peace, the Department of National Defense evolved an almost unique plan of assistance for civilian flying. When a club is organized, with the help of the association, and receives the approval of the Department, the club deposits a bond with the Government and receives the loan of two de Havilland Moth aeroplanes. The planes are used for instructional purposes and are maintained by the club, title remaining with the Government. If the club is able to acquire a machine of its own, the Government matches this with another on loan. In addition to this substantial aid, the Department pays the club $100 for each pilot the club graduates to a commercial license. The whole system of Government aid is a development of that given light aeroplane clubs in Great Britain by the British Government.

When news of the formation of Toronto's club reached Sir Charles Wakefield, the English oil magnate who is popularly known as the patron saint of civil aviation, he very generously presented the club with a Moth. The first two planes under the Government's plan were delivered during the summer and the rapidity with which membership was sought soon enabled the club to purchase a machine of its own. There are two more machines coming from the Department to offset the pair which the club owns outright. In spite of trebled capacity, the de Havilland factory in Toronto is still far behind its orders and delivery of the two machines is not expected until late this year or early in 1929. So popular has the light aeroplane become in Canada through the activities of the flying clubs that Canadian manufacturers find it impossible to keep up with orders.

In the early days of the club, R. Carter Guest, now chief instructor, was the entire paid staff. The fleet consisted of the presentation plane, the "Sir Charles Wakefield," and the ground staff did not exist. Since then E. C. Burton has been appointed assistant instructor and four mechanics are employed. By the simple expedient of buying a fifth Cirrus motor, little time is lost with the planes from engine overhaul. Both the instructors are ex-Royal Air Force men, having served in France and also instructed in England. The course they follow is very thorough. As Lieut. Burton remarked, the object is to turn out skilled pilots rather than an indiscriminate lot of flyers who, to use his own phrase, "can get through the air but are none too reliable."

Naturally, the course begins on the ground. A few lectures on rigging, construction, the theory of flight and the principles of the different types of aircraft engines are given. Believing that the only place to teach a man to fly is in the air, the instructors soon take their pupils up for dual hops. During the war, pilots of the R. A. F. were frequently sent up solo after less than three hours' dual training. There were no voice tubes then, either. After a very few more hours at solo flying they were shot across the Channel to be fed into the jaws of the war monster.

Not so today at the Toronto Flying Club. Unless he is an ex-pilot of war-time experience, no pupil is sent up solo until he has had ten or more hours with an instructor in the front seat. When he reaches the solo stage, the student sets out to put in the fifty solo hours requisite for a commercial license. But the exactions of the instructors do not cease there. After a student has done about fifteen hours alone, the teacher takes him up and gives the pupil a thorough check-up on his ability. This is repeated as often as necessary until the would-be aviator is ready to take his examination for skill.

Some people have called this examination unduly stiff. The results, in the form of the expertness of pilots as assured by such an examination, easily refute that charge. In order to prove his skill, the student must make a solo flight to an altitude of six thousand feet. Up there he shuts off his motor and glides to a landing. Up he goes again, puts the ship into a right-hand spin, takes her out and glides to earth. This may be done from any height over a thousand feet. Then he makes a third climb upstairs, this time going into a left-hand spin on the trip down. The craft must be extricated from this and again landed from a glide.

These movements are mere preliminaries, for the student must next make six figure-of-eight turns about two marks. This test must be carried out at fifteen hundred feet. The final task consists of making four climbs to fifteen hundred feet and gliding to a landing each time no farther than fifty yards from a designated point. If the student survives all these maneuvers and has executed them to the satisfaction of the chief instructor, the latter recommends him to the Air Board for a license as a commercial pilot. The erstwhile fledgling has achieved his wings and may pilot an aeroplane for hire.

The flying field used by the club is at Leaside, comparatively close to the center of Toronto. During the latter part of the late unpleasantness it was used as a testing and instruction field by the Royal Air Force, which then trained some pilots and

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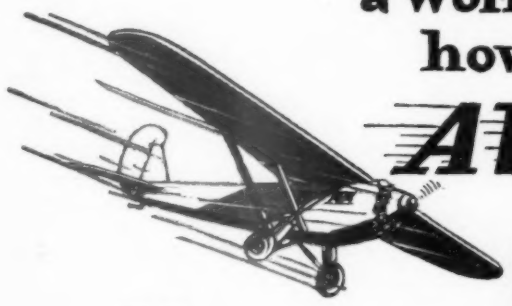

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built machines in Canada. Fighters and bombers were built in Toronto for the British Expeditionary Forces and were tested at Leaside. Many pilots, including some now famous in aviation history in the United States, learned to fly at Leaside between 1916 and 1918. The field is operated by the club, with some slight assistance from the city, and hangar space is rented to the National Air Transport, Limited, a recently formed Canadian organization, of which Captain Earl Hand, D. F. C., president of the Toronto Flying Club, is the directing head. This concern operates a Buhl Airsedan, a Buhl Special, the latter at present the fastest commercial machine in Canada, and two Moths.

Leaside aerodrome is the customs airport for Toronto. All visiting planes arrive there, and the recently inaugurated air mail service between Montreal and Toronto, operated by the Intercolonial Airways of Canada, Limited, uses the field. Visiting aircraft landing at Leaside during the past summer included a United States Army Pursuit Squadron of 15 Curtiss Hawks and a Martin bomber from Selfridge Field, the Goodyear blimp "Puritan" from Akron, the trimotor Fokker owned by the ill-fated Belgian financier Captain Alfred Lowenstein, the tri-motor Ford plane which went to Greenley Island and is now owned by the Canadian Skyview Lines of Niagara Falls, and many machines from other United States cities. Canadian craft came from Montreal, Quebec, Ottawa, Hamilton, London, Windsor, and one or two Western Canada cities.

The club has more than two hundred members on its rolls, more than half of whom are taking flying instruction. Many of these held commissions in the R. A. F. during the war days and need only take the prescribed "refresher course" to acquire licenses. Very few of the members are able to devote full time to their course, and have to take instruction when and where they can steal an hour or two from business. So far, only two women are taking flying lessons; one is about ready to do solo flights.

In addition to producing trained pilots, the club is bending much energy to the furtherance of private flying. In fact, one member recently purchased his own machine, an Avro Avian, similar to the Moths, which he keeps at the club field. Planes from the Toronto club take part whenever possible in any function of another Canadian club. The most recent of these was the Canadian Air Show in Montreal, sponsored by the Montreal Light Aeroplane Club. The Toronto club was also responsible for much of the success of Canada's first national air show held last summer at the Canadian National Exhibition, in Toronto.

The club does no joy riding, or aerial taxi work. That is left to the commercial organizations. The directors of the club consider it their duty to devote the whole equipment to the task of turning out efficient pilots. In doing this the club is fostering the flying spirit Canada so amply demonstrated during the trying days between 1914 and 1918 when Canadian flyers were in such a large majority in the Royal Air Force.

Temple University

Temple University has been most fortunate in having a most thorough and complete Ground School which is made possible and is actually given by the Navy Department for the purpose of giving training to young men that will qualify them for Commissions as Ensigns in the Naval Reserve, Class AF, with designations as Naval Aviators.

Applicants for this training must be within the ages of 18 and 27 and citizens of the United States. They must be college graduates, or attending college at the time, or possess the equivalent of a college education. They are further required to pass a stringent flight physical examination to determine their fitness for Naval flight duty. As an indication of their ability to pass this physical examination they will be required to have a medical certificate from one of the designated local Department of Commerce Flight Surgeons.

The course of training which leads to a commission in the Naval Reserve is preceded by a preliminary Aviation Ground School Course in which theoretical aviation subjects are taught. This course is conducted at Temple University under the direction and supervision of Lieutenant Commander R. S. Hedtler, Commanding Officer of this Naval Reserve Unit of the Fourth Naval District which is situated at Philadelphia.

Other universities, having this same type of training and having the Aviation Ground Schools, are Massachusetts Institute of Technology; New York University; University of Washington; University of Michigan; and Leland Stanford University. Possibly these courses will be made available through other universities but at the present time the available funds are so limited that it is necessary that the courses be restricted to the six mentioned above. The courses are given at the most strategically located points so that the graduates are near enough to naval air stations to be able to keep their hands on military planes. The next year's course at Temple will graduate candidates for training into both the Navy and Marine Corps Reserve and the other universities will probably do the same.

Those whose qualifications are the highest both mentally and physically, are selected for enrollment for actual flight training. Primary training for qualified students is conducted at the Naval Reserve Units at Far Rockaway, New York, or Squantum, Mass.

The primary flight training consists of ten hours of dual instruction in a training type seaplane followed by thirty hours of solo flight in the same type plane.

During the period of primary flight training the student is ordered to active duty for a period of six weeks. Due, however, to the limited number of ships available it is seldom possible to give the student his required hours of solo time during this period. Since the full thirty hours of solo time must be completed before he can be sent for advanced training it is necessary for him to report to the Unit as often as may be necessary during the ensuing months in order to complete the full amount of flying. This means that the student practically is required to live in the immediate vicinity of the Unit, at least until he has completed his required flying.

If a student successfully passes the examinations in the theoretical aviation subjects and completes his flight work he is then eligible for advanced training at the Naval Air Station, Hampton Roads, Va., or Pensacola, Fla.

The advanced training course is normally given the following summer, but in some instances can be undertaken during the same summer that primary flight training is completed. The advanced course consists of advanced theoretical instruction and about 50 hours of flight work in service type aircraft. This course covers a period of at least six weeks at the end of which the student takes a professional examination for his commission as an Ensign in the Naval Reserve.

During the time that a student is undergoing primary and advanced

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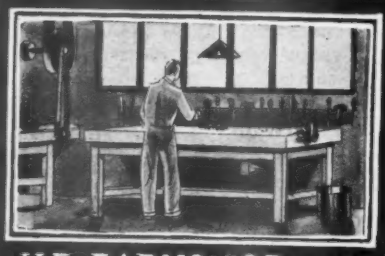

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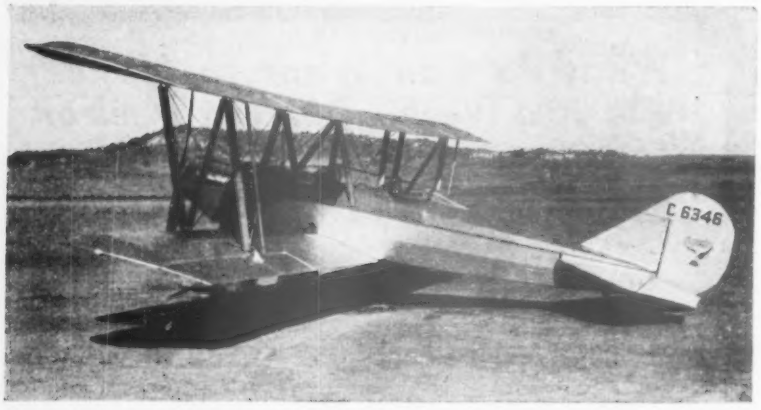
training he is enlisted as a seaman 2nd class and designated Student Naval Aviator, and his uniform is furnished him. His pay and allowance during the two six week periods of training average about $84 a month. In addition the Government provides his transportation to and from his home to the station where he is to be trained.

A Survey of Clubs

The special committee of the National Aeronautical Association appointed to study the possibilities of organizing private flying clubs on a national scale, with the N. A. A. as a national coordinating body, has arrived at the following tentative and preliminary recommendations.



The provision shall be made for the organization of private flying clubs as chapters of the National Aeronautical Association, and that there shall be no limit upon the number of such chapters that may be formed in any community, and that such a chapter should have the privilege of electing its own members and setting up its own standards of membership.

The operations of such flying club chapters should prove to be of great mutual assistance, and they can profit largely from each other's experiences exchanged through a committee of the N. A. A. as a coordinating body. In order that such experience may prove of the greatest possible general usefulness and that private flying may develop with the greatest feasible rapidity and on sound lines, it is advisable that a standard set of by-laws and flying rules should be adopted, and followed except where local conditions make change clearly advisable.

The draft of rules which the committee thinks would be advisable are in the process of preparation and are not yet ready for general distribution, but it is hoped that they soon will be. The rules have been designed to insure safety in operation and to minimize the financial hazard both to the individual pilot and to the chapter.

With the latter end in view it is hoped that arrangements can be made for the securing of insurance on favorable terms by the handling of a number of planes operated by flying chapters as a group. The committee is investigating this matter further and will soon report.

The development of the private flying clubs should continue to receive the attention of both the members and officials of the association. It seems to the committee, both from direct reasoning of American conditions and from observation of foreign experience, that there is a definite place for such clubs and that their formation should be encouraged. There are slow important prospective advantages from a grouping together of many clubs in a national organization, in preference to their operation as completely independent units.

Alexander Aviation Scholarships

To alleviate the present shortage of trained men in the aircraft industry, the Alexander Aircraft Company is endeavoring to interest more college students in aviation by offering a new Eaglerock plane, or a complete university course in aeronautics, to the undergraduate who submits the best series of four short monthly articles on aviation from January 1 to May 1.

The winner will be awarded a 4-year scholarship in a leading aeronautical engineering school, or in a school of business administration which supplies an aeronautical background. As an alternative award, the winner may choose a completely equipped Eaglerock. Lesser awards will include 10-hour solo flying courses. Awards will be made June 1.

The papers, technical or non-technical and 400 to 600 words in length, must be submitted to a committee on awards the first of each month from January 1 to May 1. In addition to the awards, the winner, if he qualifies, will be employed in the engineering or some other department of the Alexander factory.

The contest is an innovation, inasmuch as it marks the first time an airplane has been offered as prize in a contest.

Popular Aviation is now
AERONAUTICS

New Uniforms for the Flying Cadets

The Secretary of War has approved that blue shall be the color of the uniforms which are being issued to flying cadets. This is the first change in color to take place since the war. A few minor changes are also noted in the style; a roll collar, trousers without cuffs, dress caps of overseas design, black kid shoes, black patent leather dress belt, a white shirt, and a black tie to be worn with the coat. Judging from the photograph, the new uniforms will be more comfortable than the others used up to this time, and a neater appearance will also result.

AN OPEN LETTER to Ambitious Young Men

T. E. BRALEY, Chief Ground School
O. P. HARRAH, Operation Manager
JOHN FLOURNOY, Chief Flying Instructor

TED BRALEY, President
J. E. AMES, Business Mgr.

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My Dear Sir:

Do you know why Wichita is called "The Air Capital"? There's a reason.

It is because here are seven aircraft factories humming with industry, manufacturing 60% of all the airplanes used in America today.

Do you know why the Braley School of Flying is the outstanding institution of its kind in the great Southwest? There's a reason for this, too.

It is because we are pioneers in aviation, and are the first Flying School in the world to help build and establish Wichita as "The Air Capital."

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Yours truly,
Ted Braley
President.
The BRALEY SCHOOL OF FLYING, Inc.

P.S. Do you know that over 20000 pilots will be needed in the next 24 months.

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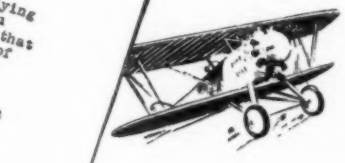

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Pilot Joe Salzman and Oscar Rothlin standing beside the landing gear which was spliced in mid-air.

Repairs in Mid-air

ONE of the most spectacular feats in aviation history was accomplished at Mills Field, San Francisco, last fall, when an instructor climbed out on the wing of his plane and repaired a shattered landing gear while a student with only one hour solo held the ship on an even keel.

Pilot Joseph Salzman, former army flyer, and now instructor for the Deaton Air Service, was bringing his Waco plane in at 10:30 a. m., after having given his pupil and mechanic, Oscar Rothlin, some air work. The ship hit a little hard and Joe felt the undercarriage give way to the left. He opened full throttle and took off with the left wheel dangling under the center of the ship.

Pilots and mechanics dashed out to the runway waving their hands, and holding up spare wheels to warn Joe of the crash that was inevitable, on the assumption he did not know of the mishap and might try to make a normal landing. Autos with horns shrieking sped from headquarters building to the field with fire extinguishers and emergency medical kits.

But Joe started to circle the field until he reached an altitude of 5,000 feet. In the haze of the morning at times he vanished completely from sight of those anxiously watching below.

Aloft, Joe motioned Oscar to take the controls and himself crawled out of his cockpit to survey the extent of the damage. He saw that the bolt holding the left wheel of the split type landing gear had been sheared off by the impact. He crawled back into his cockpit, where he cut up the leather safety belt into strips and tied the pieces together. From a small tool box under the seat he took a steel punch to use as an emergency bolt.

Joe throttled the motor, set the plane in a gentle glide, told Oscar to hold the ship in that position and again got out on the wing. He crossed his feet back of the rear flying wire, leaned far out over the leading edge and succeeded in getting the leather noose over the wheel. He pulled the wheel up against the strut. The U-fitting of the strut, however, had been sprung and no bolt would go through.

In the meantime, E. E. Mouton, Department of Commerce inspector, arrived, and with the assistant field superintendent braced on a wing and with a parachute in his lap took off to lower the 'chute for the student to jump. Also, an emergency call was sent for the fast police boat

(*Continued on page* 108)

Scientific Models

THIS term—"Scientific Models"—is often used, but seldom does the author stop to explain, or even give any substantial indications that he knows just what "science" there is about model making. There is, nevertheless, a very effective science in the making of record models. Sometimes the neatest model makers have been beaten by crude model makers. This occurs when the crude model maker has used the scientific model methods, and the neat model maker has not. Let us think, investigate, consider, if you will, where have all of the recent improvements in model making come from? Are they the work of a few days, weeks, or months?

No! For years, in fact, the only real scientific model work—the research and experimentation which made all of the recent successful nation-wide model meets possible—was accomplished by the members of the Illinois Model Aero Club, and a very limited few elsewhere: a few in New York; Washington, D. C.; San Francisco; Portland, Oregon; and Denison, Iowa. England deserves very honorable mention, too. The English model flyers are the only ones of these from whom the I. M. A. C. derived any new research data not already discovered and used by the I. M. A. C.

Real, honest-to-goodness, technical research was, and is, carried on with remarkable success by the Illinois club. Aerodynamics, streamline, wing sections for models, strength of model materials, new uses for balsa, paper tests, doping experiments, flight tests, theory and formulae proven or discarded, accurate weight calculations, etc., down a long list, are mixed together and the best skimmed off in the form of record models, contest winners, and honors. Every member builds his own machines and flies them, too! Finally, when it was found in recent years that competition was useless without this scientific background, the Illinois Model Aero Club gave out certain of their developments so that they might have the pleasure of more keen competition from other localities. This "release" of ideas—if I can politely call it that—has proven most beneficial to every model flyer in the United States and even in foreign countries.

Every model flyer in the world uses "cans" (a simple device, but unthought of until developed by the I. M. A. C.), every flyer who uses the drilled nail or cotter pin steel bearing, every model flyer who uses the streamlined pontoons or the "A" frame tailplane, every model flyer who has wondered where most all of the best practical contest rules came from—and so I could name many other things: owes thanks to the quiet, plodding workers in the I. M. A. C.—both past and present.

The work of the Illinois club has made the difficult appear simple. Just as boys can build workable radios because research has developed and greatly simplified them, so very young boys can now build models easily that fly half a mile and more, using principles, proportions, and devices developed by the I. M. A. C.

Of course, there are a number of these pioneer secrets which are not yet known. This is evidenced by the fact that records and prizes are still being "copped" regularly by I. M. A. C. members and their friends. In fact, they are evolving valuable new ideas faster than they are being released, officially or otherwise!

I know this bit of truth may be tiresome reading to some, painful to a few, but a revelation to quite the majority of you. You will be more interested if I tell you that one of the good secrets not generally known heretofore is about to be told. One of the greatest helps in model research will be explained in detail—the scales. Others have used such scales a little, but none with more thorough effectiveness than the I. M. A. C.

The elimination of all possible weight is an essential prerequisite for real record models. On the other hand, too much weight reduction is more dangerous than not enough. Some of the recent "crack" model flyers at recent national contests found this out. There is a fairly well defined limit for the minimum weight of any certain model unit and for any certain type of construction. Almost every I. M. A. C. record model approaches this minimum in every part. Record models are often lost. They outfly their pursuers, or they fly beyond the boundaries of the small and inadequate flying areas often provided for important contests.

The surest way of being able to duplicate a lost model effectively is not only to retain accurate drawings, but to keep a record of the correct weights of the original parts. Buy, beg or borrow—don't steal—a good scale; or better, make the simple scale herein described, and then weigh and record the total and unit weights of your next contest or "record breaking" model.

The cheapest accurate and suitable scales are the photographer's or druggist's scales; but even so, such scales cost more than it is necessary to spend for weighing accurately the featherlike parts of a model.

A cheap, accurate, and simple scale, weighing very accurately to 1/100 of an ounce (and often to 1/1000 ounce) can be made in a short time in the following manner:

Find an old or worn out alarm clock in which the balance wheel pivots are in line with the frame posts. (See drawings.) You need only the frames, the balance wheel, and the pivot screws. Be careful not to lose these screws, but polish the hollow cones inside by twisting a pointed piece of balsa around to clean out the dirt. (Do this occasionally when the scale is in use, too.) Carefully lay the screws away, while you cut off the part of the frame which is not needed. (See drawing.) Also cut the balance wheel down so that one spoke with about ⅛ in. of the rim on each side of the spoke remains. The hardest part is now done.

A beam graduated accurately with fine lines into inches and 1/10 inches is made as shown in the drawing. A scale can be carefully and accurately drawn on stiff paper and pasted onto the beam or you can use the printed scale shown on the drawing. Simply cut out the two 6 in. strips and accurately joint them together onto the beam. Fasten this beam securely to the free spoke of the balance wheel. The top edge of the beam should be fairly close to the pivot level, about 3/16 in. to ¼ in. to give the beam a slow, accurate "swing" or period. Some I. M. A. C. members use ¼ in. to 5/16 in., others ⅛ in., but for fast work and good work 3/16 in. is about right. Fasten a needle or a pin to the end of the beam as a pointer.

Make certain that it is just 1 in. from the pivot to the pan support. This should be closer than ½ of 1/64 to weigh to 1/100 of an ounce. It should be within 2/1000 of an inch,

if you are equipped to make it that accurate.

Now mount the clock frame on a shelf or in some convenient place so that you can hang long rubber motors, frames, wings, etc., below the pan, or lay long sticks across the pan. Clean the pivot points carefully and mount the beam between the pivots, as shown. Drive two nails into the shelf out at the end of the beam. (See drawings.) Mark an arrow on the shelf to serve as a zero.

Make a pan with a hook beneath as shown. Hang it by a tough silk thread *exactly* 1 in. from the pivot points. A long screw with a suitable nut can be added as an adjustable counterbalance weight.

One ounce Avoirdupois is equal to 28.35 grams. One tenth ounce Avoirdupois is equal to 2.835 grams (metric). Have your chemistry instructor make an exact 2.835 gram weight—a piece of small copper or plated wire (about No. 14) will do.

Set this weight on the zero mark and balance the scale by changing the weight of the pan or by shifting the counterweight. You are now ready to weigh your parts and start on a new plan of developing record models.

Example: A 12 in. indoor propeller should not weigh over 4/100 of one ounce. Let us see where the beam weight would be. As our pan is 1 in. out from the pivot, and our scale balances with the 1/10 ounce beam weight at zero, we can put 2/10 ounce in the pan 1 in. out, and balance the beam again by moving our 1/10 ounce beam weight out exactly 2 in.

To weigh an unknown piece, such as the 12 in. indoor propeller, we move the beam weight out until the beam pointer swings equally on each side of the zero mark on the shelf. The beam weight is found to be 4/10 of an inch out from zero, for example. The propeller weighs 4/10 ×1/10, or 4/100 of one ounce. A 12 in. beam will weigh a maximum 1.2 ounces with 1/10 ounce at the end.

You can increase the capacity of the scale by having a larger weight or by using two weights in combination. The extra weight should not exceed 3/10 of one ounce.

Put a known correct weight on the pan, about ½ ounce or even 1 ounce, and check to see if the beam weight balances the beam at the ounce mark. If it does, you can be satisfied. If not, the pan is not located exactly 1 in. out, or the beam weight is off, or the scale was not balanced at the zero no load position in the first place.

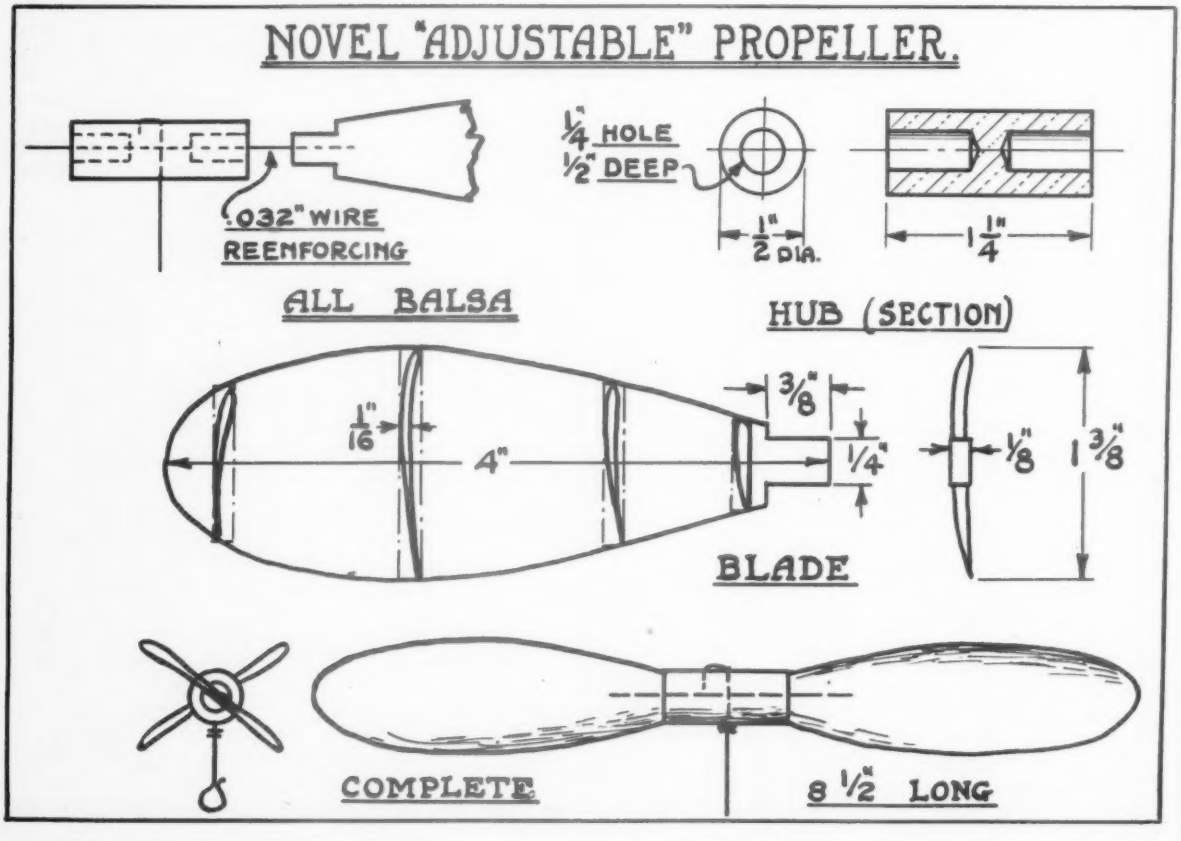
Just remember, for every inch away from zero, the weight of your scale weight balances an equal weight on the pan. Each 1/10 inch on the beam is 2/100 ounce for a 2/100 ounce weight, 3/100 for a 3/10 ounce weight, and so on. The 3/10 ounce weight 9.4 in. out on beam balances .3×9.4, or 2.82 oz. on pan, etc.

A 15 in. indoor model with ⅛ in. rubber which weighs over .16 ounce will probably never break a record.

The new World Record Hydro Model weighed exactly 2.91 ounces, with a large part of this weight being rubber—a new thought, total weight to rubber weight. On big planes, the horsepower loading is a very important performance factor. On a model, it is a more important factor. And rubber weight (properly disposed) controls the model's power in a very positive way.

Oh, yes, you can begin to see wherein scales are a great model help. You can see where calculations, and performances can be predicted by the use of the scale. You can visualize a new land of research. You will understand why most I. M. A. C. men keep weight data on their

Adjustable propellers developed in the Memphis Model Aero Club.



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HERE'S a wonderful little ship you'll be proud to call your own. A perfect, Flying-Scale Model of the "Spirit of St. Louis"; a miniature duplicate in design, appearance, and construction details. All parts and fittings closely imitate the original.

Specifications:

Wing Span: 36 in. Wing Chord: 6 in.
Length: 26 in. Weight: 10½ oz.
Speed: 33 6/10 m.p.h. Wing Loading: 14 oz.

Build it the IDEAL way; the easiest and most practical way to construct models of real Airplanes. Then you'll have a strong, sturdy ship, with heavy, powerful rubber motor that will drive it through the air for long, perfect flights.

Complete Construction Outfit (illustrated above at left) contains everything required, including Scale Plans, actual-size Diagrams and Patterns and complete Building-Flying Instructions.....Price, $7.50

West of Denver, Colo., and in Canada—$8.00

Ask Your Dealer for IDEAL Model Airplanes and Parts, Supplies and Materials for Model Builders. If unobtainable, send your order direct to us. Catalog mentioned below contains full information.

IDEAL AEROPLANE & SUPPLY COMPANY, Inc.
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Established in 1911
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Why IDEAL Models are the most perfect copies of Real Airplanes

it is possible to make in models that will fly—

IDEAL Plans are reduced by scale from the actual plans of the original Airplanes—Propellers are carved from blocks of hard wood; breakable balsa wood is not used. Propeller shafts are 1/16-in. steel rod and have miniature ball bearings. Stream-line Aluminum Disc Wheels have real brass bearings and pneumatic tires.

IDEAL Construction Outfits make building easy. All wood parts are cut to size; ribs ready formed; propellers fully carved; all metal fittings are strong and ready for use. Accurate plans, ½ actual size, and Diagrams and Patterns, full size, also complete Building-Flying Instructions, are included in each outfit. Build the IDEAL way—then you will have a better model!

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Plans for Models—25c

Complete Plans and Instructions for any one of the following Models sent for 25c; New York-Paris (Spirit of St. Louis); FOKKER; DeHavilland; Curtiss; NC-4 Seaplane; Bleriot, Taube or Nieuport Monoplanes; Cecil Peoli Racing Airplane. Catalog included free.

machines. Messrs. Cook, Pease & Schweitzer were some of the early I. M. A. C. users of the scales as a help in the design of their former record scientific models.

A sample wing data card reads as follows:

"Wing No. Ca 37 in. x 5 in.; curve, Club No. 4; Beams .080 oz., Ribs .075 oz. Assembled Uncov., .175 oz. (.02 oz. diff. represents cement.) Covered & Doped .29 oz. Recovered Superfine Tissue .24 oz. Remarks: In Combination, 4a best flight 247 sec. dur.—non-flexing in flight, 4 degree dihedral. Improved rubber weight ratio over wing C in combination 4a by 4 per cent."

We will refer to various weights and weight ratios in describing record models from time to time so make your scale now.

Memphis Model Aero Club Exhibit

Mr. George Steed of the Memphis Model Aero Club writes us regarding an exhibit of his organization at the Tri-States Fair. A large number of models were exhibited, as chosen by their instructor, Mr. Forrest Green. Among the various models were a Stinson-Detroiter, entered by James Smythe; a Dornier "Dolphin III," by George Steed; Cessna, Harry Stidham; Monocoupe, Hugh Hentna; Bremen, Walter Fransioli; Curtiss Falcon, Roy Workman; Sea Hawk, Willard Matthews; Sky Pirate, Mervin Rosenbush; Baby R.O.G., Joe McCoy; Army Pursuit, Milton Scharff; and a Rappold, by Joe Smythe.

This display created much interest and comment. People were amazed at the exactness of detail in the little models. The ships were judged by Jack Nelson, and two models were given official ribbons by the Tri-State Fair commission. James Smythe won first, with George Steed second.

A model flying exhibit was held in front of the grandstand out of doors before a capacity crowd. Mr. Steed reports that a large number of the planes flew outside of the limits of the flying field. Garvin Fransioli won first place with Billy Whitman second.

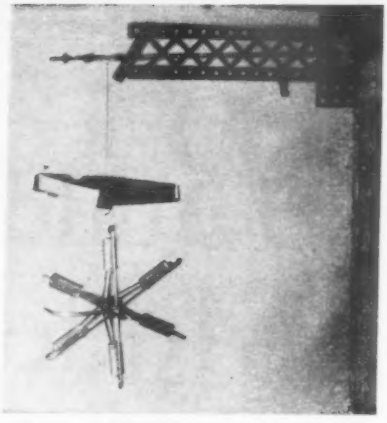
Both first and second places in this important Tri-States Fair model meet were won by POPULAR AVIATION designed models (the "C" model). You will remember the "C" model as the efficient little flyer which was described in the September, 1928, issue of POPULAR AVIATION. These simple yet efficient models will be worth the while of anyone to construct. Their simplicity perhaps discouraged a few, but those who constructed the "C" model from our plans reported performances far exceeding the modest claims of the Model Editor. The "C" model has even placed in national contests, for it is really a scientifically constructed and designed little plane of record style and general proportions. Yet it is small and easy to carry and very sturdy.

In the outdoor commercial contest at the fair, several of the ships were cracked up, but Mervin Rosenbush was first; Willard Matthews, second; and George Steed, third.

A large, unwieldy, five foot model was introduced by Harold Bullion. Because of its bulk and apparent lack of scientific design, it failed to rise at this contest. Perhaps Harold will use scales on his next model and attain better flying results.

Mr. Steed reports that a flight almost equalling the world record was made in the outdoor duration contest. We should all watch the interesting progress of this club, and look to improving our own records, or the Memphis club will be taking them away from their present holders.

Go to it, Memphis! The world is wishing you the best of luck in learning aviation by experimenting with models.



The author's own scales, showing a 6 cylinder compressed air motor similar to those to be described soon in Popular Aviation.

Bringing home the models after a competition flight.

Novel Propeller Devised by Memphis Enthusiasts

Two, three, and four bladed propellers can be made upon the novel plan suggested to the Model Editor by the Memphis Model Aero Club.

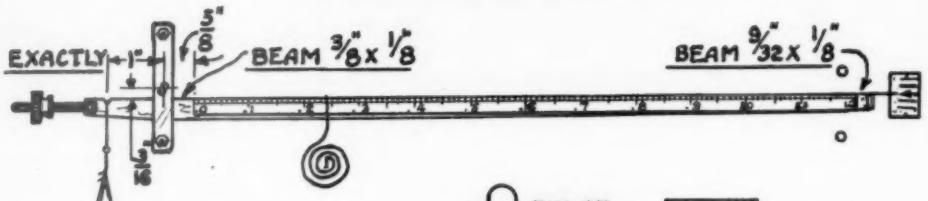
Though the propeller is not of true pitch, it is of very interesting construction, and by proper use of sand paper, a slight amount of correct pitch can be worked into the flat balsa blades. A two bladed style of propeller is shown. The following materials are required for an 8½ in. propeller: 2 strips of balsa, 4 in. x 1½ in. x ⅛ in.; 1 block of balsa, 1¼ in. x ½ in. x ½ in.; ambroid, piano wire, and a sharp knife.

The hub is made round and a ¼ in. hole is drilled into the hub ½ in. deep in each end. The blade is sanded to a thin edge with 1/16 in. thickness through the body, and ⅛

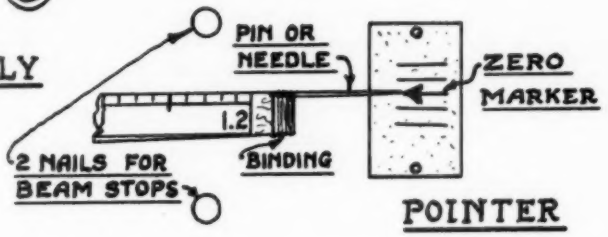
SCALES

FOR THE SCIENTIFIC DESIGNING OF MODEL AIRPLANES.

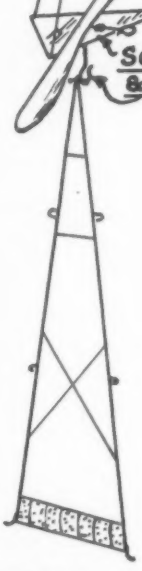
(ALL RIGHTS RESERVED.)

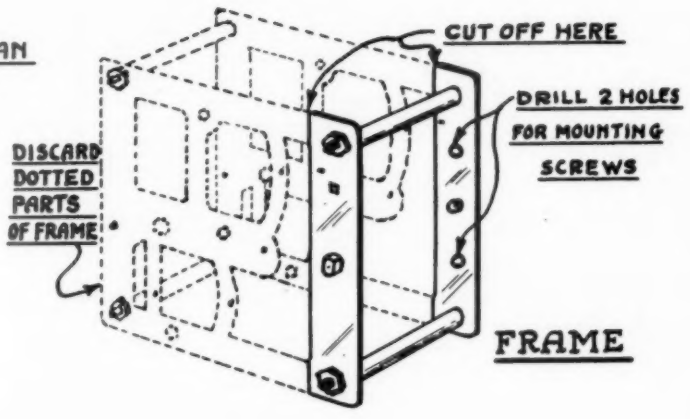


ASSEMBLY

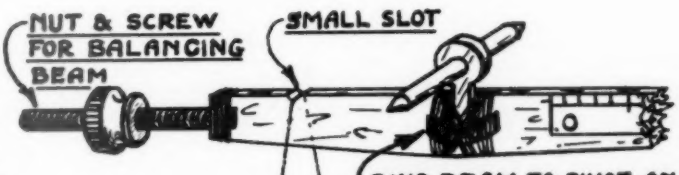


POINTER





FRAME

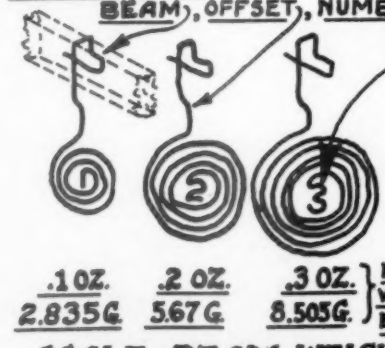


NOTE:- BEND-TO SQUARE THE WEIGHT ON THE BEAM, OFFSET, NUMBER

BIND BEAM TO PIVOT ON SIDE WITH LONGER AXLE - TO DISTRIBUTE THE WEIGHT.

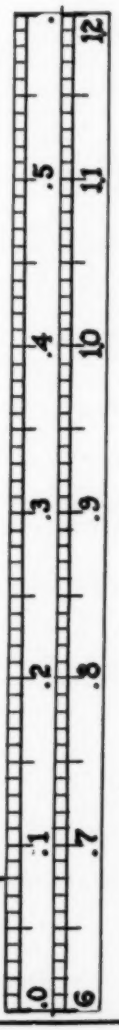
WIRE SPREADER TO AVOID THREAD RUBBING ON SIDE OF BEAM.

BEAM DETAILS



.1 OZ.	.2 OZ.	.3 OZ.	MAKE WEIGHTS EXACT.
2.835G.	5.67G.	8.505G.	

SCALE BEAM WEIGHTS



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Types—Spirit of St. Louis, Lockheed Vega, Curtiss, Hawk-Curtiss Racing Seaplane, Fokker-Trimotor F-10.

Features—Spec. 6 cylinder radial compressed air motor, 1500 R.P.M. Will fly fast approximately 1½ minutes. Very powerful. Tested to be as near foolproof and as strong as possible. Has shock absorbers like real plane. High efficiency propeller. Special glass-like finish. Special light rubber tired wheels, spec. axle unit. These planes are more than just toys.

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in. right at the point where the blade joins the hub. The two blades are inserted in the hub, and ambroided in place. If the ambroid is properly applied, and a sufficient amount used, this will make a very sturdy joint. However, before ambroiding, the blades should be twisted to the desired pitch. The hub can be reinforced by inserting a piece of piano wire about .032 in. in diameter, so that it pierces the hub lengthwise, as shown in the drawings, and enters into the stub end of both blades.

This novel idea may appeal to quite a number of us model enthusiasts, as it makes propellers which are very similar to the micarta and standard steel adjustable pitch propellers used on large planes.

Illinois Model Aero Club

DURING the latter part of 1911, members of the Aero Club of Illinois conceived the idea that a Model Aviation Club could be organized in this state, as well as an Airplane Club, in order to help promote aviation.

Many of the members of the Aero Club had visited all of the high schools in Chicago and suburbs, giving lectures on Model Aviation, how it would benefit them when they got into the big aviation game, and announcing the first meet for model airplanes.

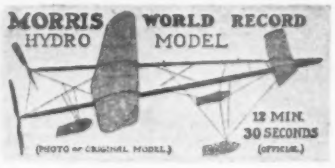
In December, 1911, the meet was held in the banquet hall of the Auditorium Hotel and there were over fifty machines entered (sizes from a toothpick to a battleship), with an attendance of about two hundred. Even a few girls entered machines. Prizes were given, with the result that a ninety-foot flight won first prize.

A meeting in January, 1912, in the Auditorium Hotel was held and the Illinois Model Aero Club was organized, the constitution drawn up and the election of officers held.

During the early spring the club held its first outdoor meet at Cicero Flying Field. A large number of models were entered at this meet and there were over five hundred spectators. The crowd was very enthusiastic at this meet and it was necessary to have marshals to keep the people back of the starting line.

Harry Wilds won first, and the distance covered by his model was 971 feet. Cruver won second—525

BUILD A GENUINE



KIT everything you need, wire parts formed, select balsa, large drawing, full instructions, only $3.00 or $4.40 with carved propellers—postpaid. Flies as well with wheels or hand launch!

PICTURE, 5"x7" clear close-up—postpaid $1.00.

S.E.5 BIPLANE—Famous War Scout Plane. Flies swell! Looks keen! Special price complete materials with blueprint postpaid $2.25, or with the ribs and propeller completed $4.95.

AMBROID—More for less money. $.35 alone or only $.28 if ordered with other materials.

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JAPANESE TISSUE—Big 21"x31" sheets, light and tough. Order 5@$.30 or 10@$.55 postpaid.

SUPERFINE JAPANESE TISSUE—Smooth, tough, extra light, 18"x24". Order 5@$.55 or 10@$1.05.

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Ace E. Z. Built Junior Set, Spirit of St. Louis, 33-inch wing span

Balsa wood sides. Balsa wood ribs, balsa wood disc wheels, feather weight propeller shaft, propeller, with spinner cap, dummy air cooled motor, demountable motor stick which gives you distance flights of 700 feet or more, blue print. Directions, model dope and all that is needed to build this wonderful machine, packed in a neat box $4.50.

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AIRPLANE 12-inch scale model of Lindbergh's Spirit of St. Louis. Scientifically designed and very realistic. Equipped with rubber band motor. Rises from ground by own power and flies 30 ft. or more. Easily built without tools. Construction set, with all parts and full directions, postpaid in U. S. only 50c (no stamps). Satisfaction or money back. Send now.

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BOYS!—Learn to Construct and Fly Airplanes

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Powerful Motor
Special Propellor
Rubber-Tired Disc Wheels

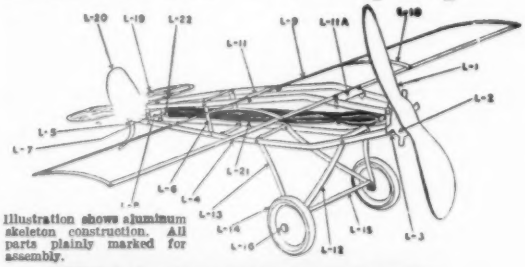
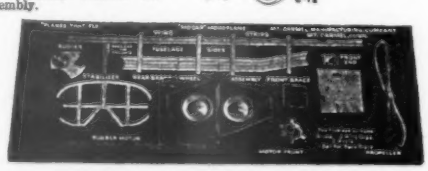


Illustration shows aluminum skeleton construction. All parts plainly marked for assembly.



Illustrations show set mounted complete ready for assembly. All metal skeleton ready for covering, and actual out of finished plane

THE "MOCAR" Monoplane is a practical, simply designed, real model airplane that *flies*. It is constructed of aluminum parts, all perfectly formed, ready for assembly. No special tools or punches needed for assembly—just pliers. All rivets, bolts, disc wheels, rubber tires, wing and fuselage covering materials are furnished.

When completed, this plane flies wonderfully—taking off from the ground. It is strong and will stand considerable abuse. Replacement parts are furnished at small cost.

This is an ideal model airplane that offers instruction in both airplane manufacture, and in flying. It is well to remember that all *real* airplanes are first tested by making *models*.

It is great fun to construct and fly "MOCAR" model airplanes

Full instructions and illustrations for assembly are printed on the board to which the parts are mounted. Shipped complete in box.

The plane has a wing spread of 18", fuselage 12". A very powerful rubber motor, propellor of strong construction and rubber tired disc wheels. All parts made of aluminum.

Set No. 1 is modeled after Lindbergh's Spirit of St. Louis. Construction set, (Postpaid $1.50.) Model L made up ready to fly. (Postpaid $2.25.)

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Signed name.....

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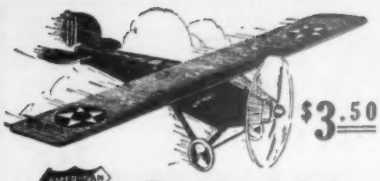
P. O......



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Has all-metal motor mount, sturdy wings, scientifically designed aluminum propeller and shock absorber landing gear with rubber-tired wheels.

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feet; and the third prize was won with a distance of 350 feet. This flight of 971 feet was a splendid record for the club at the time and everybody was proud of it. The best local flight for the club during 1912 was 1,628 feet. The members of the Aero Club of Illinois awarded cups to Harry D. Wells (1st prize), and Arthur E. Nealy (2nd prize) for the best showing in the model meets of the year.

The next year (1913) the distance jumped to 1,800, 2,240 and 2,740 feet. This flight of 2,740 feet was made by Arthur E. Nealy and was then a world's record. During that year the boys of the club started to build model hydro-airplanes and the first meet was held at Lake Calumet. The best duration was 17 seconds, made by Don Cornell.

In 1914 the Illinois Model Aero Club held meets for all types of models, such as hydros, hand launches, R. O. G.'s (rise off ground) and tractors. After flying hand-launched models during the years of 1912 and 1913, you can see how the boys advanced to other types of models in 1914.

During the year Joseph J. Lucas and Addison Cruver each gave a cup for a series of three hydro meets (known as the J. J. Lucas and A. Cruver Hydro Model Airplane Contests) to the members who made the highest total duration and the best duration flight of the series. Ellis C. Cook won the Joseph J. Lucas Cup for the highest total duration and Joseph J. Lucas won the Addison Cruver Cup for the best duration of the series. This series of contests helped to stimulate the hydro work and later made it possible to increase club twin push hydro record to 57 seconds—by Ellis C. Cook.

The year 1915 was the club's best flying and active year since its organization, breaking four world's records, beating the Milwaukee Model Airplane Club at Chicago in an inter-state distance duration, R. O. G. Meet, and winning over 65 per cent of the prize money and the Villard Trophy for the year. The world's records broken were hydro duration (twin push) 100.6 seconds, by Ellis C. Cook; hydro duration single propeller (tractor)—116 seconds by Lindsy Hittle; hand-launched distance (single propeller tractor) 240 seconds, by Donovan Lathrop, and hand-launched distance (single propeller tractor) 1,039 feet —by Donovan Lathrop.

In the Inter-state Meet Ellis C. Cook made an official American R. O. G. duration of 134.4 seconds. During the early part of the year the Mozart Cup was donated to the club by the Mozart School of Chicago, for stimulating model aviation among its members, according to the rules of the Contest Committee. In September the club had given a two-day model flying demonstration at Milwaukee for the visitors at the Wisconsin State Fair.

The Mozart Cup is given to any member of the club who breaks one of the ten recognized world's records not held by the club. The cup is held by the member until another member breaks another one of the world's records (of the recognized classes), and so on until all ten records are broken. The member breaking the last record of the recognized ten receives the cup permanently.

The Villard Trophy is awarded to the club whose members collectively make the best showing each year in the National Model Airplane Competition and the club winning it three consecutive years becomes its owner.

In 1916 the club entered the National Airplane Competition, winning 72 per cent of the prize money and the Villard Trophy again.

During the National Model Competition two world's records were broken: Thomas Hall, the hand-launched distance (twin push) 5,337 feet—57 feet more than a mile, and D. W. Pease the R. O. G. twin push distance—3,364 feet. D. W. Pease won the Laird-Weaver Trophy for making the highest total score in all the model meets held by the club for the year.

The Laird-Weaver trophy donated by Emil Laird and George E. Weaver to the Illinois Model Aero Club, to be given to any member of the club for one year, making the highest total score in all the model meets was held by the club for the year.

In 1917 the National Model Airplane Competition was called off owing to the World's War. Even though many of its members had enlisted in the Army, Navy and Marines, three world's records were made by Phillip Breckenridge. They are as follows:

Hand-launched tractor distance—2,200 feet.

R. O. G. (rise off ground) tractor duration—227.4 seconds, and

R. O. G. tractor distance—2,685 feet.

W. D. Sprague won the Laird-

Weaver Trophy for the highest total score of the year.

There was very little model flying during 1918 owing to the war and the National Model Airplane Competition was called off again. Despite the very little flying two new world's model records were broken. Hand-launched (twin push)—230 seconds, by William E. Schweitzer. Hydro duration (twin push)—118 seconds, by Bruno Likosiak. William E. Schweitzer won the Laird-Weaver Trophy for the year.

The year 1919 was very successful for the club won the Villard Trophy for the third consecutive time, and is now permanent owner of it. During the Model Airplane Competition, *Aerial Age Magazine* put up six medals as prizes. The club members had won all of them, making a 100 per cent clean sweep of the Competition. By winning the Villard Trophy for the third time the National Model Airplane Competition ended.

The club members are indebted to the following fellow members: Robert V. Jaros, Joseph J. Lucas, Ellis C. Cook, William Schweitzer and Ward Pease who made it possible for the club to become permanent owner of the Villard Trophy.

During the year William E. Schweitzer broke the world's R. O. G. (twin push) distance record of 4,029 feet. He again won the Laird-Weaver Trophy for the year.

The Illinois Model Aero Club had a big exhibition during the Aeronautical Show at the Coliseum in 1920 and drew a large crowd at the club booth. Many fine exhibits were also given at Marshall Field's Department Store during the year. As a result of these exhibits the club received fifty new members.

During the year the club had carried out its regular model flying schedule and held its meetings. Two more world's model records were broken—hand-launched single propeller tractor distance record of 2,465 feet, by Bertram Pond, and the hand-launched twin push record for 300 feet at 45 M. P. H., by W. Wakin. Robert Jaros won the Laird-Weaver Trophy for the highest total score of the year at model meets.

The year of 1921 was the greatest year for the Illinois Model Aero Club in its history so far. Five world's model airplane records were broken and the big exhibit and indoor model meet during the Chicago Pageant of Progress were both successes. The indoor meet was the best the club ever held and as a result of this and the exhibit, the club received 85 new members.

Mr. Bertram Pond, with his indoor hand-launched single propeller duration machine made a world's record of 170 seconds at this indoor meet, and received a pair of Alfred Johnson racing skates, and also won the Mozart Cup permanently for breaking this last world's record of the club's ten recognized classes of rec-

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Send 5 cents for complete parts list. A 5 cent service charge is required on all orders amounting to less than $1. A 5 cent packing charge is required on all shipments of wood or metal greater than 18" in length. Prices are subject to change without notice. All goods sent postpaid in the U. S. A. No stamps or C. O. D. orders accepted.

	Spruce	Balsa
1/8"x1/8"x3'	.03	
1/8"x 1"x3'		.06
1/8"x1/8"x2'	.03	.033
1/8"x1/4"x3'	.045	.054
1/4"x1/4"x3'	.054	.06
1/4"x 1"x3'		.24
1"x 3"x3'		.48
1"x 3"x3 1/2'		.56

Reed 6' lengths, 1/32" diam. .05c; 1/16" .075c; 3/32" .10c; Balsa discs 1/4" thick 2" diam. .07c; 3" .08c; 4" .09c.

Ambroid dope, 1/4 pint .50; 1/8 pint	.95
Ambroid cement, 2 oz. .33; 4 oz.	.53
Bamboo paper 13x36" .12; 24 3/8"x33 3/8"	.14
Rice paper, 18"x24, .09; 21"x25"	.06
Wood veneer, 20"x30"	.22
Flat rubber 50' of 1/8", .50; 50' of 1/4"	.75
Piano wire 3' of No. 5 or No. 8, .04; 3' of No. 11 or 16	.06
28-30-32-34 steel wire, per spool	.10
1/4" copper washers, 10 for	.05

We can supply any size balsa that you need, also propellers, I beams, wing sections, bolts, nuts, screws, brads, aluminum, brass tubing, turnbuckles and books on model building.

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BUILDS ANY ONE OF 4 DIFFERENT MODELS

Contains a mammoth set of parts, plans and instructions to build a real flying model of Spirit of St. Louis, Fairchild, Fokker or Bremen. Rubber-tired aluminum wheels. Indestructible aluminum propeller and motor mount. Heavy, multiple-strand Para Rubber motor. Planes guaranteed to stand rough usage, and to fly 300 ft. if instructions are observed. Outfit, prepaid anywhere in U. S., $3.00. (Plans and drawings only 50c).

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All parts, drawings and instructions to make it, only $1.00. Has aluminum propellers, two powerful rubber motors, highly cambered 16" wing, and adjustable elevator. Makes a high-powered, long-flying job you'll be proud of!

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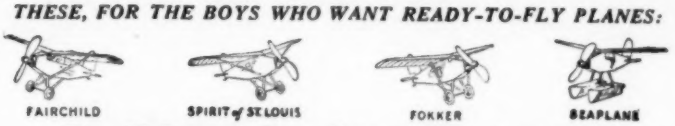
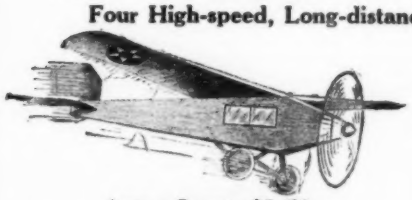
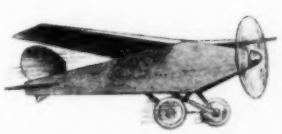


Four High-speed, Long-distance Fliers at $5 Each



Army Scout, $3.50

Fibre wings and fuselage. Aluminum propeller and motor mount. Rubber-tired landing gear. 19" wing spread. Beautiful colors, accurate design, and a fine flier!



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Built much like the Army Scout, but with 17" wing spread. Big favorite with boys all over the country.

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Clinton Model Airplanes

ords. The other world's records which were broken are as follows:

R. O. G. (rise off ground) twin push duration of 209.4 seconds by Robert V. Jaros.

Hand-launched (twin push) duration of 265 seconds by Robert V. Jaros.

Scale model (indoor gear driven) rise off floor duration of 22.4 seconds, by Robert V. Jaros.

R. O. W. (rise off water) twin push duration of 172 seconds, by Bertram Pond.

Robert V. Jaros again won the Laird-Weaver Trophy for the highest total score of the year's model meets.

The Model Club in 1922 had another big exhibition during the Chicago Pageant of Progress. Twenty-five new members joined the I. M. A. C. as a result of this exhibition and many Model Airplane Contests and meetings were held. Robert V. Jaros won the Laird-Weaver Trophy for the third consecutive year for the highest total score of all the contests for the year.

The year 1923 was also very successful for the I. M. A. C. The club made a splendid showing at St. Louis during the Mulvihill Model Airplane Contest, winning the first nine places of the model plane race. Edward J. Lange won first prize money and the Mulvihill Trophy for the Club with a time of 262 3/5 seconds. Mr. Lange's model hand-launched twin push flight was only 2 2/5 seconds under the world's duration flight made in 1921 by Robert V. Jaros of 265 seconds. Robert V. Jaros was second in the contest with a flight of 239 1/5 seconds. Both Lange and Jaros received gold and silver plaques of the Mulvihill Trophy, and the first seven contestants made a clean sweep of all the prize money. Mr. Edward J. Lange received the Laird-Weaver Trophy for the year. Members of the Illinois Model Aero Club also made a clean sweep of the prizes at the Chicago Model Airplane Tournament.

The Mulvihill Trophy is awarded each year to the club, body or chapter represented by the entrant of the winning model.

Gold and silver plaques are given by the donee to the owners of models winning first and second places in every contest for this trophy.

The Illinois Model Aero Club had another big and successful year in 1924, breaking five world's records and winning the Mulvihill Trophy again. Robert V. Jaros accomplished the most remarkable feat ever performed—more than doubling his own record of 4 minutes 25 seconds by making a hand-launched twin push duration record of 10 minutes 14.2 seconds, winning the first prize and the trophy for the club at Dayton, Ohio. Paul Shifler Smith of the club won second place with a hand-launched single propeller tractor duration of 3 minutes and 20.4 seconds. All of the first seven places and prize money went to the club contestants.

Robert V. Jaros and Paul Shifler Smith received gold and silver plaques of the Mulvihill Trophy for first and second place. Two other world's records were broken at this model meet—the single propeller pusher hand-launched duration of 2 minutes 48.5 seconds by Walter L. Brock, and twin propeller hand-launched distance of 7,920 feet by Robert V. Jaros. The other world's records broken at the club meets were single propeller tractor hand-launched duration of 9 minutes 42.2 seconds, and single propeller tractor hand-launched distance of 6,024 feet by Paul Shifler Smith. Robert V. Jaros won back the Laird-Weaver Trophy for the highest total score of the year's model contests.

The next year—1925—the club entered the Mulvihill Model Airplane Competition at air races in New York and won the Mulvihill Trophy for the third consecutive time. The weather was very cold and windy and it was impossible to make a long duration flight. Mr. Bertram Pond won first place. The best time with his hand-launched twin push was 2 minutes 38 seconds, winning the Mulvihill Trophy for the club and a gold plaque for himself. Mr. Paul Shifler Smith with his hand-launched single propeller tractor of the club placed second—time 2 minutes 26 seconds. For this flight he received a silver plaque of the Mulvihill Trophy. Even though the club had only seven contestants in the meet it won five out of eight prizes, or in other words, 89 per cent of the prize money. Mr. Paul Shifler Smith won the Laird-Weaver Trophy for the highest total score of the year in all the club's meets.

The Mulvihill Trophy was put up for competition again in 1926 at the Sesqui-Centennial International Exhibition held at Philadelphia, Pa. Some of the club members could not very well stand the expense of the trip to Philadelphia and therefore only a few attended the meet. Model flying conditions were not very good and it was a tough break for the I. M. A. C. to lose first place and the trophy. Mr. Joseph J. Lucas of the club managed to get second place, receiving a silver plaque of the Mulvihill Trophy and a silver Sesqui-

Centennial International Medal, with a duration time of 2 minutes and 9.2 seconds. Mr. Pond placed third with a duration of 1 minute, 57.2 seconds, receiving the bronze Sesqui-Centennial International Medal.

Mr. Lucas' hand-launched twin push model had two new features that worked very well on this type of model—the tail plane in the frame and the high lift elevator.

Several weeks after the Sesqui-Centennial Meet an official flight was made at the I. M. A. C. Contest of 6 minutes and 19 seconds.

Lucas won first place in all the model contests for the year held by the I. M. A. C., and was awarded the Laird-Weaver Trophy for the perfect total score.

The year 1927 was marked by the great advance that Model Aeronautics made. Although only one world's record was broken the year was very successful from the standpoint of the number of boys who were interested in the science of Model Aeronautics. During the early part of the year the club held a model exhibition at the Boy Scouts Show. The exhibit was a great success and ten new members joined the club as a result of the exhibition.

Due to the increase in interest in model aviation two national meets were held. The club was not very successful in the first meet of the year, which was the National Indoor Model Airplane Contest, held at Detroit, Michigan, March 19th. Failure to win this meet was not due to lack of leadership in design, but to the fact that the club was not in a position to have a full representation at the meet. The club representatives at this meet were as follows:

Joseph J. Lucas—best flight 1 minute, 58 seconds, due to the lack of time in preparing.

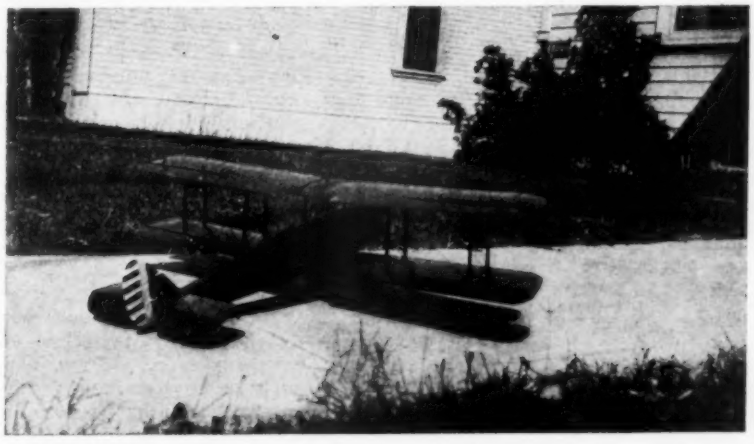
Bertram Pond, best flight—1 minute, 5 seconds, due to experimenting with a new way of controlling the tendency of the model to stall at the beginning of the flight.

The second meet of national scope was held at Memphis, Tenn., October 8th. The club was represented at this meet by only two members as official contestants and by two members who acted as mechanics and managers. These representatives were: Messrs. Jack Lefker, Bernard Schwartz, Walter L. Brock and Eugene Docherty. The flight of the Lefker Model—5 minutes and 37 seconds—(which was designed by Joseph J. Lucas) was the outstanding one of the meet, and set a new junior world's record for hand-launched twin push. Jack Lefker, even though in the junior class, more than doubled the flight of Jack Loughner of Detroit, the winner of the same event in the senior class. Jack Lefker also won second place in the indoor glider duration contest of 7 seconds. Bernard Schwartz won second place in the outdoor commercial hand-launched model contest with a flight of 6 seconds for the Junior Class.

Donald Lockwood made a new fuselage model record of 1 minute, 24 seconds.

For the year of 1927 Donald Lockwood won the Laird-Weaver Trophy for the highest total score. The old members, not competing in any of the club's meets for the year, devoted their time to instructing the new members in the science of model building and flying.

The year 1928 has started off with a bang, breaking three world's model airplane records. The records are as follows:



Fuselage indoor rise off floor model, 1 minute, 36 seconds—by Donald Lockwood;

Twin push hand-launched indoor model, 1 minute, 35 seconds—by Carl V. Carlson; and

Hand-launched pusher and pull indoor model—1 minute, 49 seconds, by Donald Lockwood;

The club already held the Model Exhibition at the Boy Scouts Show and from what interest the boys are showing in model aviation many had joined the club to learn more about the subject.

The reason for the Illinois Model Aero Club being so successful in its work is that the club holds its regular meetings on the 1st and 3rd Fridays of each month and model contests on the Sundays following the meetings. If you are interested in model aviation and want to learn more about models, write or call and the members will be glad to help you out.

Simple Aerodynamics

(*Continued from page* 46)

Problems

1. Define "Lift of an Airplane."
2. Define "Drag of an Airplane."
3. (a) How is the Resultant Force on a surface obtained?
   (b) What is the Center of Pressure?
4. A plane is flying at an air speed of 80 m.p.h. against a 20 mile wind. What is the speed of the plane relative to the ground? What would be the speed relative to the ground if the plane was flying with the wind? Ans., 60 m.p.h., 100 m.p.h.
5. The coefficient of resistance of a square flat plate placed perpendicular to the wind is .0032 in Engineer's Units. What will be the resistance of a plate of 10 square feet in a wind of 100 m.p.h.? Ans., 320 lbs.
6. A square flat plate normal to a wind of 120 m.p.h. has a resistance of 210 pounds. Find the area of the plate. Ans., 4.5 sq. ft.
7. A rectangular wing has an area of 300 square feet and a span of 40 ft. Find the chord and aspect ratio. Ans., chord 7.5 ft. Aspect ratio 5.3.
8. What is the lift force on the wing in Problem 7 in a wind of 80 m.p.h., if the K_y coefficient is .00132? Ans., 2,534 lbs.
9. Find the drag force under the same conditions as in Problem 8 if the value of K_x is .000198. Ans., 380 lbs.
10. What is the L/D ratio of the wing in Problems 8 and 9? Check your answer by finding K_y/K_x. Ans., 6.66.

XUM

An Aviation Clearing House

THE first inkling that the Clearing House might be the very thing to fill a long felt want came to us in the form of a telegram asking us to locate an executive with certain definite requirements. This was done inside of three hours. Three high type men were placed in touch with the organization seeking aid.

At the present moment there are few positions in the entire field for which we could not find a qualified applicant by means of a search of the data returned to us.

Manufacturers and operators of aircraft should be interested in the lists being compiled by POPULAR AVIATION from the replies to the first announcement of the Aviation Clearing House. The first list contains the names and addresses of over 250 men, who in age, experience and other qualifications, are fitted for positions in the aircraft industry.

There are men on this list with over 1,000 flying hours to their credit. There are some who have been military instructors. There are others with valuable engineering experience. There are still more who have the proper qualifications for positions as mechanics. There are painters, welders, fitters, riggers, fabric men, and other skilled trades, all with actual aviation factory experience.

For sales help there will be another list, and still another for office help. These applicants have not had the definite aviation experience of those in the first list; but the first examination of the data submitted by them shows many men in both these classifications that are of high caliber and splendid qualifications. Many of them have had special training in lines that should prove of immense advantage to employers.

The great surprise to this office was the enormous number of replies, coupled with the unusually large number of really qualified applicants for positions.

The preparation of the lists, together with the classification of applicants by occupations, experience and type of situation wanted will take time; but in the meanwhile we invite correspondence from interested employers regarding open positions. When fully compiled the lists, with names omitted and numbers substituted for identification purposes, will be sent regularly to employers engaged in the field of aeronautics.

For the benefit of those who missed the first announcement of the Aviation Clearing House we can repeat that this department of POPULAR AVIATION offers to act as a go-between for employers and men seeking employment in aviation. However, there are a few simple conditions attached, which must be observed.

First: Do not write a letter. Use the blank printed on this page. Letters will be disregarded. If the blank does not contain sufficient space, paste it on a 3 by 5 card and use the reverse side of the card for the additional information.

Second: We cannot undertake to answer any correspondence from applicants.

Those who are seeking positions can be assured that their applications will be confidential, and that lists sent out to an employer will not contain the names of any of his own employees.

In filling out the application blanks please bear in mind that the facts wanted are those in which an employer is interested. You do not have to state you are interested in aviation, as that may be taken for granted. An application for "any sort" of position is not apt to be considered by an employer who thinks men should have definite ideas as to their own capabilities. State your experience, education and other qualities as briefly and completely as possible.

The Clearing House will receive this application and after classification will submit it, with others, to various manufacturers, operators, training schools and other employers, in the form of lists of available employees.

It is our belief that this Clearing House can perform a function of real value. It can become the means of placing the industry in touch with experienced men and with the raw material from which the best employees are made.

Name ..... □

Address ..... City ..... State .....

Age ..... Married / Single ..... Nationality .....

Education .....
(State here course at college, high school or equivalents)

Aviation Experience .....

.....

Pilot ..... Mechanic ..... Kind of License ..... No. of Hrs. .....

Business Experience .....

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.....

Position Desired ..... Minimum Salary .....

Start When ..... Will you go anywhere in U. S. .....

After carefully filling out in a legible manner send it to POPULAR AVIATION, Aviation Clearing House, 608 S. Dearborn St., Chicago, Ill.

Popular Aviation is now AERONAUTICS

Aeronautical Travel Bureau

"The time is near when men will receive their normal impressions of a new country suddenly, and in plan, not slowly and in perspective; when the most extreme distances will be brought within the compass of one week's—one hundred and sixty-eight hours'—travel; when the word inaccessible, as applied to any given spot on the surface of the gobe, will cease to have any meaning."

A little over twenty years ago Rudyard Kipling made the above observation—or prophecy, if you chose to call the working of an unusually observant brain by that name.

Today it is possible for men to receive their impressions of a new country suddenly and in plan—and thousands of Americans can testify to its truth. A brief study of the statistics of European air lines shows that forty-five per cent of their passengers are Americans.

With Americans furnishing so large a percentage of the traffic on the great air lines of the Continent it is obvious that a central bureau for the dissemination of information about air travel in Europe would be welcomed by the thousands of Americans who plan a European trip during the coming season.

POPULAR AVIATION is prepared to furnish such data, accurate and up-to-date, and to prepare itineraries for the traveller, giving costs, routes and all other information about desired trips.

The popularity of air travel in Europe is due to its usefulness, particularly to the American traveller. It provides a thrilling and novel way to see a new country. Little time is lost in surface transportation and a maximum number of days are allowed for sightseeing. Were it possible for the average American visitor to Europe to look forward to such a trip year by year, he might be content to visit but a single country on one trip. Unfortunately such trips are few and far between and the visitor is compelled to crowd as many days of sightseeing as possible into his vacation period.

Air travel over the safe and luxurious lines of the great European countries has changed this, and travellers are now enabled to see more of every country with a greater degree of comfort.

Itineraries are being worked out that will provide for trips of fifteen, thirty and forty-five days. Naturally the time spent in the air will be comparatively small and the stop-overs at the interesting and historical spots will be ample. Fares, hotel accommodations and all information will be worked out for trips that will take in North, Central and Southern Europe.

Tentative arrangements for the fifteen-day trips covering three different tours are approximately as follows: A Northern Country Tour allowing three days in London, one day for a trip to the Shakespeare country, one day for seeing London, and one leisure day, followed by a trip by plane to Amsterdam, allowing two days in and about that city, including a steamer trip to the Isle of Marken. The sixth day by plane to Berlin, the seventh for city sightseeing, the eighth day for an excursion to Potsdam and Sans Souci, and the ninth for a day of leisure. To Stockholm by air on the tenth day, with ample time to see the city, by rail to Oslo with the twelfth day spent in that city; then to Copenhagen by air, with a full day for that city; then returning to Hamburg by air on the fifteenth day. Such a trip would cost approximately $500.00, with all railroad, airplane and steamer fares included, also all first class hotel accommodations, meals, tips, baggage care and transportation, and all fees for sightseeing, including motor coach, automobile, steamer and the like. Strictly personal items have not been figured.

A second tour would start from Hamburg, allowing sufficient time for seeing the sights, and then to Cologne by air, and the following day an air trip to Frankfort over the Rhineland. From Frankfort to Munich by airplane, with a day spent in private automobile excursions to Oberammergau, Neuschwanstein or Hohenschwangau. On the fifth day a trip to Zurich by air, with a day in Zurich, followed by the rail trip to Lucerne, where the Rigi is visited by mountain railway, and later a trip to Interlaken by bus, through the Grimsel and Furka passes. On the tenth day a trip to Montreux via the scenic Bernese Oberland railway; then by boat back to Geneva. From Geneva to Paris by airplane via Lyon; two days for sight seeing in Paris including trips to Versailles and Malmaison, and to London by airplane on the fifteenth day. This trip, including the expenses mentioned above would cost approximately $500.00, which would include all except strictly personal expenses.

A third trip could be arranged for the same sum, starting from Munich, and going to Vienna by plane, with a day for a trip to the Semmering, from Vienna to Venice by airplane, two days at Venice for sightseeing, including an excursion to the Lido; an afternoon trip to Rome by airplane, with two full days in the ancient capital of the world. On the ninth day a trip to Naples by plane, followed by an excursion to Capri and the Blue Grotto, and thence by boat to Sorrento; from there back to Naples by private automobile via Amalfi and Pompeii. Another day in Naples and then back to Rome on the 12th day by plane. The trip from Rome to Genoa by airplane; from thence to Milan by train, and from Milan to Zurich by rail, reaching there on the fifteenth day.

A combination of the three trips could be made for a reduced figure as savings are apparent and there would be no doubling back.

There is an awe-inspiring beauty to be found in one's first glimpse of the world's greatest city, London, from the air. The rough Channel is merely "the ditch" to those who take the air from London to the Continent. No one fails to exclaim over the first sight of a Dutch city from the air. Tiny rows of houses, like cardboard cut-outs, dikes, moles, quaint boats, and the ever present windmills—Holland certainly looks Dutch. There is the medallion of the Ile de la Cite of Paris. There are Rhine castles seen in all their beauty and inaccessibility. The kingdom of island jewels—Denmark—presents itself to the traveler by air in a way no other person can appreciate. For sheer beauty the flight from Switzerland through the Alps and over the plains of Italy cannot be excelled.

POPULAR AVIATION will welcome inquiries from those contemplating air travel in Europe during the coming season. We will be pleased to extend to them all the facilities at our disposal in the arrangement of such a trip and give them the benefit of the experience of our foreign connections. Address The Aeronautical Travel Bureau, POPULAR AVIATION, 608 S. Dearborn St., Chicago, Ill.

XUM

Our Library and Yours

READING of general interest in the field of aeronautics is represented in the books published during the last month. Possibly more specialized than the others is a manual of flight instruction by Lieut. Barrett Studley of the Navy. This is a thorough, first-rate work, of particular interest because it contains instructions on the operation of both land and sea types of airplanes. "The Airplane and Its Engine," written by two professors in the Aeronautical Engineering Department of Massachusetts Institute of Technology, is an uncomplicated, broadly planned statement of the elementary facts of aircraft design and performance. Commander Byrd's adventurous career forms the theme of an attractive biography by Charles J. V. Murphy. Travis Hoke and E. B. Free are the authors of a highly entertaining account of the ways of the weather. "Weather" is one of the most alertly written books which we have received recently, and it should appeal to all owners of umbrellas, galoshes, thermometers, or colds.

WEATHER, by E. E. Free and Travis Hoke. Robt. M. McBride & Co., New York: 1928. 337 pp. Illustrated.

We all talk about the weather; unless we are from California we criticize it; our home and clothes and food are conditioned by it; we live altogether under its patronage. And yet, in spite of the fact that weather is almost the only feature of our environment which concerns all of us closely the whole of the time, we have made little effort to understand it. Obviously this lack of study has not been due so much to lack of curiosity as to lack of practical means for undertaking even the simplest sort of meteorological research. The detective methods at the disposal of investigators of weather phenomena have until very recently been too slow and clumsy to be of much use.

Within the last few years, however, considerable headway has been made in learning the ways of the weather. It has been known for a comparatively long time that weather is cosmopolitan, and that to understand it at all adequately we need to have simultaneous reports from widely separted points of observation. This information is becoming increasingly available, and as a result, our knowledge of the weather is steadily advancing.

"Weather," by E. E. Free and Travis Hoke, is one of the most comprehensive and readable books on this topic that has appeared. It is not a manual or a dryly technical discussion of meteorology. The authors present weather in all its aspects in a very lively way. Apparently the book was planned inductively. Tolerant friends and acquaintances of the writers were asked to tell what they wanted to know about weather. The responses to this invitation were assembled, and the book attempts to provide answers.

Actually it goes far beyond this point. Weather is dragged out of the treetops, and down from the hills, and in from the sea, and away from all the other remote places where it is accustomed to lurk, and exposed to view. World-wide trends in weather, cycles extending over years and even generations, seasons, tides, and climate are discussed, and so far as may be explained. There

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"Weather" is a distinctly unusual book. It is attractively planned, and written with much enthusiasm.

PRACTICAL FLIGHT TRAINING, by Lieut. Barrett Studley, U. S. N. The Macmillan Company, New York: 1928. 435 pp. Illustrated. Price, $5.00.

One of the very best among a number of good training manuals which have made their appearance recently is "Practical Flight Training," by Lieut. Barrett Studley, U. S. N., instructor in the Flight School of the Navy at Pensacola, Fla. There are several excellent features of this book, any one of which would make it conspicuous in its field. To begin with, it is the work of a naval aviator, and the point of view from which it is written is to a considerable degree that of a seaplane flyer. This is a matter of practical interest to anyone anxious to secure instruction in the piloting of both land and sea types of aircraft. Lieutenant Studley does not, of course, limit himself to a description of the flying of seaplanes. He deals carefully and in much detail with the handling of airplanes in general, but includes, as part of this instruction, specific information regarding the operation of flying boats as well as land planes.

The book is illustrated by a really splendid selection of drawings, diagrams, and photographs. There is a series of photographs taken from the pilot's cockpit which is intended to show the position of the nose of the plane in relation to the horizon during level flight, banks, turns, spirals, and landings. Better than any possible description in words, however accurate and vivid that description may be, are these action pictures.

Two other elements contributing to the effectiveness of the book are the author's sense for the organization of his material, and the thorough sobriety of his advice. In addition, Lieut. Studley writes with very much more than ordinary ability. "Practical Flight Training" deserves a more extended recommendation than it is possible to give it here. It is without question one of the finest presentations of the practical facts of flying airplanes that has yet been made.

STRUGGLE, by Charles J. V. Murphy. Frederick A. Stokes Company, New York: 1928. 368 pp. Illustrated. Price, $2.50.

A timely book, and one that will appeal to a variety of readers, is "Struggle," a biography of Commander Richard E. Byrd, by Charles J. V. Murphy. Mr. Murphy is one of the feature writers on the Staff of the *New York World*, and has had unusual opportunity to observe and, to a considerable extent, to participate in recent noteworthy events in the field of aeronautics. Those who have read Commander Byrd's own account of his career as a flyer in "Skyward" will be interested to compare the autobiography with the biography. It is one of the privileges of our generation that men of interest to the public at large can be more nearly approached, it would seem, better understood than ever before. The radio and the moving pictures of course account for this fact to a great extent, but it is also true that, partly because of the interest stimulated and encouraged by these means, written statements concerning men in public life are more numerous and more human, taken all in all, than they have been in previous times.

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esting story, because Commander Byrd has lived an intensely interesting life. After telling briefly of the Byrd ancestry, from the early colonials in Virginia to the present illustrious members of the family, Murphy begins the story of Commander Byrd's own life, and carries the narrative clear through the days of boyhood, of youth, and of manhood. The story is always inspiring because it is the record of the application of intelligence, courage, and effort to human difficulty. 'Struggle,' perhaps as well as any single word can do, expresses the force that Commander Byrd has habitually applied to the solution of a very large number of perplexing problems. But it is hardly assured enough. Commander Byrd's life seems never to have lost its tone. Byrd himself has never failed to dominate mere circumstances. Mr. Murphy's story makes this point with great vigor. 'Struggle,' as a word, on the strength of Mr. Murphy's own evidence, might well be supplemented by at least two other words equally symbolic of Byrd's attainments—purpose, and achievement.

THE AIRPLANE AND ITS ENGINE, by C. H. Chatfield and C. F. Taylor. McGraw-Hill Book Company, Inc., New York: 1928. 329 pp. Illustrated. Price, $2.50.

In their prefaces to "The Airplane and Its Engine," the authors indicate their purpose in preparing the book. They intend it "primarily for the intelligent middle-class aeronautical readers—that is, for persons interested in acquiring a sound knowledge of the basic facts and theories of the airplane—who still do not desire to give to the subject the intensive study which is essential for the designing engineer or the expert mechanic." This implied promise to the reader is kept throughout the book. Modern airplanes and modern aircraft engines are discussed with care and accuracy, but points of purely technical interest are not emphasized. The book is definitely broad in its appeal.

"The Airplane and Its Engine" makes no effort to describe the historical development of aircraft. It accepts the airplane as a present-day mechanical fact and seeks to thoroughly acquaint the reader with the essentials of design construction and performance. Previous knowledge of aviation on the part of the reader is not assumed. The parts of an airplane are explained in simple language together with their coordinated action. There are two chapters on the motor dealing first of all with the primary facts common to all internal combustion power plants. Seaplanes and amphibians are discussed briefly and there are chapters on commercial airplanes and military airplanes. The concluding chapter of the book deals with instruments and accessories.

C. F. Taylor, M. E., and C. H. Chatfield, S. M., are both Associate Professors of Aeronautics at Massachusetts Institute of Technology. Both have long and distinguished records in the development of American aviation, not only as academic investigators, but as practical designers and builders.

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Financial Survey of Aviation

By R. D. Small

General Manager of Aviation Financing and Trading

"GREET the unseen with a cheer." According to an interview in a monthly magazine that exhortation is a favorite maxim of Henry Ford. It may account for a considerable measure of his success. The unproven, unplumbed future sets up no restraint to the flight of his imagination. Much that has been done in Aviation will be obsolete in a few years. Yet Ford with his splendid advertising has struck a note of courage and confidence that inspires those who falter in this era of rapid development, and necessarily rapid obsolescence in the Aernonautical industry.

We have been asked many times, "Why invest in this new, fast changing Aviation industry now? Why not wait until it has become more stabilized, and has "set" into something generally accepted?" The writer was sneered out of buying Radio, at something under 10 because "it was a new industry." That restraining advisor would laugh at "Greet the unseen with a cheer." His appraisal for every investment was based on "what does the statement show?" You simply can't follow that rule in Aeronautical securities. There is not sufficient history of earnings. "How then have other successful investors made their selection?" was the inquiry of a well known business man, and "what is the best way to capitalize the opportunity presented in today's stage of development in airplane stocks?" Every man will answer differently. We suggest in the order mentioned the application of the following requisites: 1, Imagination; 2, Judgment; 3, Courage; 4, Patience (forgetting the 10-20 points quick turnover, and holding for several years substantial appreciation); 5, Money (with which to support Patience). But money was the last and not the expected first consideration. Compose a formula of your own, but don't forget that this is the "alert" age. It is claimed more successes are being scored through that characteristic than with any other known business attribute.

Some of the leading advances in market levels during the last month were as follows (excluding stock exchange securities): Travel Air, 140 points; Western Air Express, 50 points; National Air Transport, 45 points; Claude Neon Lights, 15 points; Keystone, 15 points; Stearman Aircraft, 16 points; Douglas Aircraft was brought out at 13½, sold at 30 two days later, now quoted at 20-24; Aviation Securities was issued at 23½, with a market at 35 when the issue was announced to the public.

One explanation for what might be called a one-way market in Aeronautical Securities is based on the fact that stocks are being continually taken out of the market by a number of Aeronautical security holding companies such as National Aviation Corporation, Aeronautical In-

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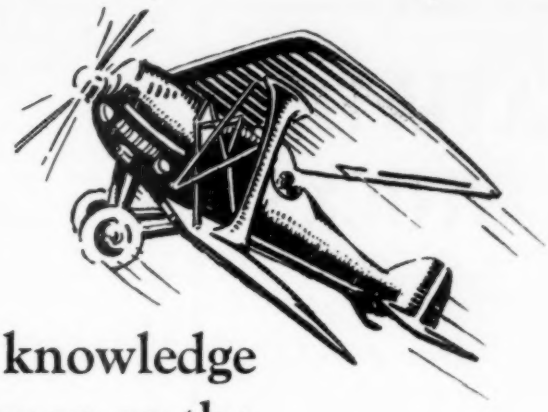
dustries, Air Investors, Aviation Securities Corp., and others. These stocks, we understand, are to be held for a comparatively long time investment purpose. This factor lessens the available supply, and creates an advancing market. We know of one holding company with a reported book profit of over $1,000,000, largely obtained since July 1. Another company just organized, begins business with book profits and underwriting profits of around $300,000. These companies have no pay rolls to deplete their earnings, and if their investments are purchased with sound judgment they should be expected to show dividend possibilities in excess of the average industrial, which has factory, executive, selling, and advertising charges to eat into the profits. There are scores of smaller holding concerns in Chicago whose investments are all in the aeronautical field. One, a group of lawyers, another a coterie of bankers, another architects and builders, and many groups of only a half dozen—and a host of individual trusts. The philosophy back of the buying attitude of the public seems to be: "We overlooked our opportunities in motors and in radio, but we will not let the Aviation industry escape. If we purchase with judgment and diversify our risk and buy now while the industry is young, and have the grit to stand by the investment for a period of years, some of these investments should pay abnormal profits."

Douglas Aircraft Co. has just been organized and stock offered at 13½, and was many times over-subscribed. Sales were reported at 30. The stock has just been listed on the New York Curb. Corporate Structure: 1,000,000 shares authorized, common (no par); 300,000 presently outstanding. The company was organized in 1921, with $15,000 capital, and has grown entirely through earnings. Net sales partly estimated in 1922, $124,000; in 1921, $1,970,000; 1928, $2,065,000. The company has orders on its books for 1929 of $2,350,000. Of the 392 planes already produced about two-thirds went to the Army, and the balance to the Navy and postoffice department. The company is now entering the commercial field in a large way. Net earnings, after all charges partly estimated, were $356,000 in 1927, and $400,000 in 1928. Profits for 1929 are conservatively estimated at $600,000. The balance sheet, as of June 30, 1928, after giving effect to financing

(*Continued on page* 106)



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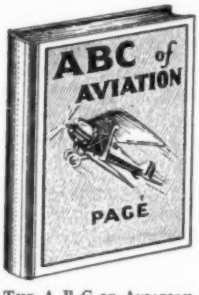

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Aviation Finance

(*Continued from page* 105)

showed current assets of $2,200,000 (of which there are $1,000,000 cash), and current liabilities $215,000. Amongst the directors are C. M. Keyes, president of Curtiss Airplane Co.; J. C. Cowden, vice-president of Blair & Co.; D. W. Douglas, W. E. Douglas, of New York; T. B. Eastland of Bond, Goodwin & Tucker; J. J. Mitchell, assistant vice-president of Illinois Merchants Trust Co.; L. R. Reed of E. A. Pierce & Co.; R. Robinson, Los Angeles; H. H. Wetzel; H. W. Elliot, Los Angeles; H. Grube, Los Angeles, Calif. Market at this writing December 6, 19-20.

Bellanca Aircraft Corporation: Is incorporated under the laws of Delaware. The plant is located at New Castle, Del., on a tract exceeding 350 acres, and includes a flying field with a large frontage on the Delaware River. The company is producing approximately one-half dozen planes a month. Their chief output is a cabin monoplane with a Whirlwind engine, seating 6, and selling for $14,500. These planes are credited with a high rating on performance, having won many trophies for efficiency. Schlee & Brock established a new American endurance record with one of this type, 59 hr. 7½ min. Financial structure: Common stock (no par), authorized, 500,000; outstanding, 175,000. The old preferred stock was exchanged for five shares of new common stock (voting trust certificates), and the old common stock was exchanged for three shares of new common. After accounting for the new financing the preliminary balance sheet, as of September 30, 1928, showed current assets, according to Lybrand, Ross Brothers & Montgomery, of $1,789,297.18, and current liabilities of $104,707.78, or 17 to 1. The management is in the hands of G. M. Bellanca, and the following directors: L. Sherman Adams, E. S. Evans, Detroit; George W. Mixter, New York; Roger W. Kahn, New York; Major F. La Guardia, New York; Alfred D. Chandler, Wilmington; Joseph H. Holmes, Pittsburgh; Andrew Bellanca, New York, and others. This stock is now listed on the New York Curb. The market is around 23.

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The company has 300,000 shares (no par) authorized, out of which 150,000 are presently issued. It is reported that 120,000 of the 150,000 were bought by the directors, leaving only 30,000 to be distributed by private sale. We understand the stock was underwritten at 23½, and registered at 35 when offered to private subscribers.

E. F. The Swallow Airplane Co. was organized January 1, 1928, with a capitalization of $250,000 common stock, $100 par value. Original organization of the company took place in 1919, and successful operation has been carried on since that time. The Swallow biplane, powered with Curtiss and Wright engines is the company's product. A 40 acre airport on the city limits of Wichita, Kansas, is owned in fee. The field is equipped with several hangars and adjoins the plant. Production is said to be booked well into 1929, on a normal basis of seven planes a week. It is expected that this number will be increased to twelve in order to take care of unfilled orders. It has been announced that the shares, which are presently selling around 125, will shortly be split-up on a ten to one basis.

Fog Piercing Beacon

(*Continued from page* 25)

Dushman, who has made a special study of light productions from gaseous discharges for the company. "However, a neon lamp of a different type with but half the candlepower was reported seen by an aviator on a clear night at a distance of 75 miles."

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M. I. T. Laboratory

(*Continued from page* 40)

World War the institute became the scene of ground schools for military and naval aviators, and was the chief naval aviation ground school. Professor Edward P. Warner, now assistant secretary of the Navy for aeronautics, was head of the department at that time.

The four years' course in aeronautics now given at the Institute of Technology is designed to train the student thoroughly in the engineering fundamentals, and then to familiarize him with the application of these fundamental principles to aircraft design, construction and operation. Advanced subjects are available for graduate students, and there are extensive courses in aeronautical engine design and testing, as well as courses in propeller design. The institute now has half the graduate students in aeronautical engineering in the entire country.

A research staff is constantly employed in the investigation of new problems, and the wind tunnels in the new laboratory are available to airplane constructors. Much of the research work of the engineering division of the Air Corps at McCook Field has been done in the institute wind tunnel. Large numbers of tests of complete airplane models have been made and will continue to be made in the new laboratory, as the institute's work in this respect has come to be recognized as standard. These tests have generally included the determination of stability, performance, and the effect of all three controls. Some work has been done in the design of tail surfaces for air ships and in tests of helicopters to determine the possibility of safe descent with a dead engine.

In the new Guggenheim building the basement is unusually deep, and is divided into two wind tunnel laboratories. The largest of the tunnels, with 7½ feet diameter, is already in use, while the second is to be constructed in the other basement division, with a diameter of five feet and a 75-horsepower motor generating a wind velocity of 100 miles per hour. This installation will include several new pieces of equipment for wind tunnel tests of airfoil models. Because of the size of the larger wind tunnel, the largest in the country, the laboratory it occupies extends from the basement to the full height of the first floor. On the second floor are staff offices, an undergraduate drafting room, a rigging laboratory and two research rooms for assistants. On the third floor are a laboratory for testing materials used in airplane construction, two large classrooms, and laboratories for research in meteorology, instruments for navigation and studies with air and water flow models, with a special photographic darkroom.

One of the most important and interesting laboratories is the rigging laboratory, designed to accommodate two full sized planes. In this room sand load tests will be made. In the materials testing laboratory will be located a Reihle Universal testing machine, with 50,000 pounds capacity. Another machine is a device for testing the strength of ribs. On the roof is to be a platform fitted with devices for meteorological observations and instruction in the use of navigation instruments.

Repairs in Mid-Air

(*Continued from page* 86)

which was dispatched to the bay which adjoins the field.

Far up in the thick haze the inspector found Joe lying on the wing trying desperately to lasso the dangling wheel. Joe recognized the inspector's plane and saw the 'chute. He shook his head and waved the inspector off, then lashed the broken parts together with the leather belting. The ship now had glided down to less than a thousand feet, so Joe took the controls until he had more altitude. He had stripped center section turnbuckles of all safety wires, and every piece of wire that he could get loose within the cockpit. Once more he crawled out into that perilous position and with the wire bound the parts of the landing gear more securely.

When Mouton landed an O2H army plane from Crissy Field arrived with an additional parachute, but Mouton declared that neither Joe nor his student would leave the ship, and that Joe was trying to repair the broken gear. As their gas supply was low it was feared that a forced landing would only make matters worse. So in huge chalk letters on the blue fuselage of the army ship were written these words:

"Follow me to Crissy Field and land in water. Boats ready to pick you up."

The plane with the powerful Liberty motor roared off and in five minutes reached the pair battling to save themselves and their ship from a crash. But Joe again waved the rescue plane off and continued to work at the shattered parts while his student sat taut at the controls.

From the ground now the watchers saw that the landing gear no longer was hanging loose and they could make out the head and arms of

Joe below the leading edge of the wing.

"He's got it fixed!" That was the cry that went up.

"Leave it to Joe," remarked a friend. "If anything can be done, Joe sure will do it."

The army plane landed with the information that the gear appeared in place.

Fifteen minutes later the Waco was seen to begin the long glide for the landing, and at 12 o'clock, exactly ninety minutes after the accident, the plane with the two who had fought so valiantly, lightly touched ground for a safe and happy landing.

"I wasn't going to leave the ship, even though I'd have to make a dead stick landing," Joe said as his friends crowded around to pump his hand. "My work was nothing. That repair job was easy. It was Rothlin who did the real work of flying the ship so steady with only one hour of solo."

And what did Rothlin, a modest Swiss boy who had served four years as mechanic in the air mail service of Switzerland, have for a comeback?

"Say, all I ask is that some day I'll be the flyer that Joe Salzman is today!"

Women's Influence

(*Continued from page 78*)

stead of inward at the same old unprofitable, egocentric ideas, emotions and desires that many of them cherish on the ground.

If they fly for the same reason that they drive their automobiles, do their dancing and swimming and sailing (anything to pass the time!); if aviation means only another diversion added to the list, another thrill for jaded tastes, another expression of physical activity, no more . . . what will be the effect on aviation?

Men flyers seem to think women will do more harm than good. But, if they fly capably enough, even in this frivolous spirit, and if they don't crack up too often (even the men who fly, crack up now and then!) they will not be harming aviation, but will probably be helping it by gradually increasing public confidence in flying.

Only—there is a thousand times more in it, than mere casual amusement!

They will be cheating themselves.

Popular Aviation is now AERONAUTICS

Lighting the Airport

(*Continued from page 62*)

efficient of reflection of about 87 per cent, while polished metals run from 40 per cent to 65 per cent.

Obstruction lights are of the same construction as boundary lights, but show red. They should be mounted on all obstacles on or near the airport, such as poles, windmills, buildings, radio masts, etc. Major obstructions should have a sufficient number of lights so that, should one lamp fail, the obstruction will still be fairly well marked till the burned out lamp is replaced by a good one.

There are times during a low ground fog when a phantom field is produced under the illumination of floodlights. The top of the fog appears to be the surface of the ground. Of course such a condition is dangerous. Many night flying pilots are of the opinion that the standard runway marker should be centered around suitable lighting equipment, protected by a housing and a cover set flush with the surface of the ground. On those rare occasions where the phantom field is

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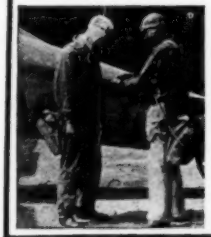

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produced, these pilots believe that if floodlights were extinguished and the marker lights only were burning, a landing could be made with less difficulty.

Acknowledgment is hereby made to the following publications, which have been freely used:

U. S. Department of Commerce, Aeronautics Bulletin No. 2, and Aeronautics Bulletin No. 16.

Illuminating Engineering Society paper entitled, "The Present Status of Aeronautical Lighting in the United States," by Preston R. Bassett, R. W. Cost, E. A. Leinroth, and H. C. Ritchie.

Civil Aviation in Canada

(*Continued from page 37*)

these clubs have throughout the winter months held regular classes under competent teachers and qualified instructors, of whom there is no lack. The aid of the municipalities has been given in the most generous and public-spirited way, and flying fields placed at the service of clubs. Civil Government air harbors will also be open to the use of these aircraft operators to the extent that their size and facilities allow on payment of moderate fees. Light aeroplane clubs using Government aerodromes will be charged $15 per month per aircraft in operation, and landing fees are fixed at $1, $2, and $3 per day.

Planes are arriving and being put into shape at the present time and clubs are geting under way without any delay since each contains at least a nucleus of expert airmen who acquired their experience under the most difficult and exacting conditions, and there is no lack of trained material. The year will see a new and revolutionary feature added to Canada's varied life and aviation added to its diversity of sports. Thus, these clubs must inevitably, with the encouragement offered and the further assistance promised, multiply until the Dominion is linked from coast to coast by short flight distances. This development will undoubtedly impart the greatest stimulation to aviation in general Canada has ever experienced, giving birth to a real civil and commercial aeronautical expansion, and revolutionizing the world standing of the Dominion in this regard. All Canadian centers will be in touch with each other by air for the purposes of any projected development, and at the same time increasing contact with similar centers of the United States is to be logically expected.

It appears at first thought to be a very advanced step that the Government has taken, but this is merely because it was so unforeseen and unexpected. Actually all the evidence points to carefully thought out and matured plans and the embarking upon such a revolutionary scheme only when it was judged to be expedient and the time ripe. All agencies in Canada have been preparing for this, to cooperate in getting Canadian civil aviation under way to a good start. Under persistent encouragement from the Government, municipalities and corporations all over Canada have in the past few years established aerial bases in readiness for some sort of development they but hazily understood, and the Dominion is dotted with them. They will be available in the first instance, together with Government aerodromes, for use by flying clubs and thereafter for all manner of commercial services. Initial aerial mail services have been completely successful and the elaborate expansion such as is definitely promised requires the linking of East and West with such aerial bases as well as the availability of trained men for the private companies which are coming into being to operate them. A network of specially equipped laboratories from Newfoundland to British Columbia is being planned as an advisory weather service for aviators. Finally Canada has now the additional advantage of manufacturing her own aeroplanes on a scale more adequate to meeting the increasing demand, the industry having developed in a remarkable manner within the past year. Altogether the stage would seem to have been carefully set for Canada's next aeronautical act, that of civil and commercial development.

Popular Aviation is now
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From Picks to Props

(*Continued from page 35*)

rotten take-off was named after Saunders, better known as "Sap." In defense of himself "Sap" always said that the fellow who originated the Chandel was a lucky student who got scared and just "pulled her back and kicked her."

Time gradually piled up and there were numerous "Brossmans" and "Saunders," with the resulting consequences of damaged pontoons, much to the dismay of the Chief Carpenter's Mate. My pal Goofy was bilged, and having been the class

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jester and wit, was a loss to all of us. After 12 hours of instruction his instructor told me that Goofy could not even fly in a straight line and seemed to have not the slightest feel of the air.

"Had my first solo stunt hop today," said one student. "I tried everything the book calls for and succeeded in doing a number of new ones the book does not call for."

"So I noticed," replied anotner. "I could hear your flying wires singing 'Nearer My God To Thee' clear down here, when you came out of that power spin. Do that very often in an N-9 and you will look like a sea gull diving for its dinner, with its wings folded back."

"I fell off at the top of a loop yesterday," I said, "and thought at first she was going to snap stall, but I managed to kick her into a spin. When one of these crates does a snap stall I would rather be on the ground looking up."

"No. 1 does a pretty falling leaf," said the first. "But I got hell for warping two valves." No. 1 had short exhaust stacks and when sideslipping the cool air would rush in against the hot valves causing them to warp.

In an effort to pile up time it was often quite dark when some students decided to come back to the station, and although night flying was not a part of the syllabus there were students who got a little of it. One student was quite surprised and a little frightened when upon coming down from 10,000 feet where the sun was still shining, he found that on the surface it was quite dark. He climbed from his plane with a sigh of relief and a reprimand.

A battery of search lights was installed on one of the hangars but was of little value as an aid to night landing because the rays reflected from the water and created a false impression of depth. It was found that a small light on the end of a pier and close to the water was of much more value in judging the distance to the water.

I well remember my first night flight. It was at the close of a day such as the one that must have inspired Carrie Jacobs Bond to write, "The End of a Perfect Day." The sun sank, a disk of flaming fire, behind curtains of lacy pink and lavender. The street lights were being lighted. The four spouts of flame on each side from the motor seemed angry with the placid mass of lights below. We were Day's spy over enemy territory seeking news of the movement of the cohorts of Night. The last faint ray of light was now gone from the west. The lights below us twinkled peacefully as though secure from all danger. The stacatto of the motor seemed out of place over such a tranquility. I awoke from my reverie to the problem of a landing in the realm of the Real. It was done. To see such a sight as this, to trespass into cloudland and snatch a glimpse of the foothills of Heaven, to watch the gradual unfolding of

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vast expanses of prairie, into rolling hills, and silent mountains,—is it any wonder that aviation is fascinating?

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It is tomorrow—we are passing through the Blue Ridge mountains on a creeping, dirty, wheezing invention of mankind, the railroad train. As we try to enjoy the scenery we are wondering if America will ever acquire an air-mindedness to the extent that she will spread her wings to enjoy clean, comfortable, safe air travel. That dream is being rapidly realized.

"One more day," said Red, "and we will get our first sight of an H-boat (HS-2L)."

"Yeah," I replied. "They call them flying coffins. I hope they are not what they are cracked up to be."

Airman, Where Do We Go?

(*Continued from page 31*)

any given position on the earth, at any given instant of sidereal time, there is only one possible altitude for each "fixed" star.

As stated by Mr. K. H. Beij when he proposed the use of the idea in Technical Report No. 198 of the National Advisory Committee for Aeronautics, the simultaneous altitudes of two stars, together with the Greenwich sidereal time of observation, definitely determine a point on the earth's surface. This may be put in graphic form by plotting the altitudes against the latitude and local sidereal time. The simultaneous altitudes thus determine a latitude and local sidereal time. The local sidereal time combined with the Greenwich sidereal time gives us the longitude. Thus with the simultaneous altitudes of two stars, and the Greenwich sidereal time of the observation, we obtain both the latitude and longitude without reference to the dead reckoning position, right ascension, declination, hour angle, or azimuth. No plotting whatever is required to obtain fix.

By reading the Greenwich sidereal time to the second, and by using a sextant from which all index error has been removed, the actual work for obtaining a fix from these curves is:

1. Taking the sextant altitudes and Greenwich sidereal time of the simultaneous observations.

2. Finding the intersection of the two curves of altitude.

3. Subtracting local sidereal time (found by projecting the point of intersection vertically to the top or bottom scale), from the Greenwich sidereal time (as read from the watch or aero-chronometer).

4. The latitude is given directly on the latitude scales at either side of the curves, and is picked off the same as from any Mercator chart.

5. The difference between the Local and Greenwich sidereal times is the longitude in time, which is con-

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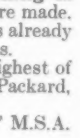

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verted into arc by means of the table on page 1.

A typical problem is as follows: Any time, any place, altitude of star Arcturus was 31°-35′, altitude of star Polaris was 42°-40′, when Greenwich sidereal time was 15-04-32. Where were we? Solution: Find the intersection of the altitude on the star curves.

Greenwich sidereal time by watch was 15h 04m 32s
Local sidereal time by curve was..... 9h 54m 00s

The difference was the longitude .... 5h 10m 32s W.
= 77°-38′ W.
Left scale reading was 43° 15′ N.

Retailing Airplanes

(*Continued from page* 21)

cash on delivery, for parts as well as airplanes, most of their distributors are selling planes on the time payment plan—having arrangements with their own finance company similar to the manner in which automobile dealers operate. Local finance companies, being familiar with the local distributors and with their retail purchasers, seem to be able to give very good service both as to the financing of floor stocks and of retail sales. In some instances, the initial payment on retail sales runs as low as 33 1/3 per cent of the retail price.

According to the Advance Aircraft Company, "There seems to be a wonderful opportunity for the individual or corporation who goes into the retail airplane business as a distributor or dealer. It must be admitted, however, that this requires business stability. In other words, the possession of a pilot's license does not guarantee the success of a retailer any more than the ability to drive an automobile makes a successful motor car dealer. At present, in addition to the profit accruing from the sales of airplanes, the dealer or distributor has the prospect of passenger work, cross-country work, photography, student training and many other aerial activities to assist him in making airplane retailing a highly successful business."

The Alexander Aircraft Company, of Colorado Springs, Col., manufacturing the Eaglerock airplane, now has 186 salesmen, distributors and dealers selling Eaglerocks. They have 2 distributors in Canada, one in Alaska, and are negotiating for representatives in South America, Australia and Europe.

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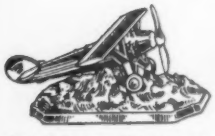
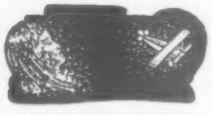


"Take-Off" No. 600 Paper Weight $1.00 each postpaid. In lots of 500—80 cents each.



"Lady Lindy" No. 200 Desk Tray 50 cents each postpaid. In lots of 500—30 cents each.

"Above the Clouds" No. 900 Ash Receiver $1.50 each postpaid. In lots of 500—85 cents each.

500-lot price of above three items includes inscription comprising three lines not to exceed forty letters, cast permanently into the metal, at no extra cost.

Additional Gift Suggestions for Those Interested in Aviation

Every home will welcome a pair of these artistic Book Ends No. 400, typifying the flight of the "plane of destiny" across the wide expanse of the Atlantic. One pair $5.00, two pairs $8.00, three pairs $10.00, may be sent postpaid to three different addresses.

Ash Receivers No. 800 are always acceptable gifts. No home can have too many—One $1.50. Two $2.50. Three $3.00. May be sent postpaid to three different addresses.

One each: Pair Book Ends, Ash Receiver, Bank, $7.50 value all for $6.25 postpaid.

Child's Bank No. 100. "The Spirit of the Times." What child wouldn't be delighted to receive as a gift a bank as attractive as this one—what more incentive could a child want to save pennies, dimes and quarters? One $1.00. Two $1.75. Three $2.25. May be sent postpaid to three different addresses.

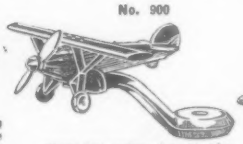
An Ideal Gift for the Motorist

For your friend with a car who is also an aviation enthusiast. He will get a thrill when he sees the propeller spin as the car moves. Made of the new discovery "Chromibrite" an unbreakable metal. Guaranteed for the life of the car.

No. 700

No. 700. The above model is appropriate for small cars like Fords, Chevrolets, Dodges, Stars, Whippets, etc. Can be attached in a few minutes. Adds to the streamlines. Price $1.00 each, postpaid.

No. 900. Same as No. 700 with the addition of a bracket to carry the plane forward to allow for motometer or other design on the radiator cap. Price $1.50 each, postpaid.



No. 900

No. 850

No. 850. Here is the Lone Eagle—a truly artistic ornament. The Spread Eagle above is a work of art, added to the graceful bracket carrying the "plane of destiny" the ensemble produces a striking effect. Price $2.50 each, postpaid.

AGENTS - DEALERS - DISTRIBUTORS - JOBBERS - WRITE TODAY FOR OUR PRICES

ANCIENT ART METAL CO.

84-86 Withers St., Brooklyn, N. Y.

Their leading distributor, the Aero Corporation of California, has sold 62 Eaglerocks since Jan. 1, 1927, earning a net profit of $20,000. They deal directly only with their 35 distributors, who in turn deal with their dealers.

The Alexander Company is said to be the first to inaugurate the partial payment plan of selling aircraft. Early in 1927 they began selling ships on a plan which involves an increase of 11 per cent in the selling price over the cash price; a mortgage on the plane, the signatures of two co-signers on the note: and a down payment of 30 per cent of the total credit selling price, with the balance to be paid in 10 equal monthly installments. "These conditions are admittedly strict, but they are necessarily so on account of the risks which are not covered by insurance. The plan is a makeshift but will suffice until the finance and insurance companies get together and work out a cooperative scheme of financing and insuring planes at rates which are far lower than the present conditions warrant."

According to President J. Don Alexander, "The possibilities in marketing airplanes among business men, sportsmen and air service operators have not been plumbed. Up to the present time, most dealers have had only to take orders. We are now advising our dealers to interest business men in airplanes as a means of increasing the efficiency of their sales organization, saving time in the transportation of materials and merchandise, and in general saving the valuable time of the executive by speeding his overland travel.

"Aircraft sales organizations have not yet reached the competitive scale of the automobile industry, and will not do so for some time."

One of the Eaglerock distributors is reported to have recently refused $20,000 for a franchise which he had held only 6 months. This is an indication of the optimistic attitude of men already in the game. A man who enters the retail aircraft industry at this juncture may expect a heavy turnover on sales, and great returns from properly managed sidelines such as sightseeing, taxi, student instruction and aerial photography.

President Alexander told aviation authorities at a banquet in his honor during the September air races at Los Angeles that the next few years would see the production of a light cabin monoplane built around a medium powered motor. Features of the ship will include excellent visi-

50,000 MEN

will make fortunes in Aviation. Airplane Drafting and Designing is the biggest job in the biggest industry of modern times. A new field of opportunity has been opened up by our improved method of training.

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DEPT. A

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City State _____

bility above and below, folding landing gear, good lateral control, slow landing speed, adjustable pitch propeller, more comfortable seats, and a cruising speed well over 100 miles per hour. Within 10 years he predicts that such a plane will become a common vehicle for business men, salesmen and others who find fast travel over long distances valuable.

The American Eagle Aircraft Corporation of Kansas City, Mo., now has more than 550 retail outlets and is adding to them daily. In the month of July, 1928, a single retailer, the Northrup Airplane Company of Minneapolis, sold 10 planes.

Their sales are handled through distributors, dealers and contact dealers; the discount to distributors being 20 per cent on the first 5 planes and 22½ per cent thereafter; the average discount to the dealer, 15 per cent; and the discount to the contact dealer, 5 per cent, the latter making his sales through the dealer supervising his territory. Single retailers for this company have earned commissions as high as $5,000 per month!

In 1929 the company promises that American Eagle Airplanes will be sold on the same basis on which motor cars are now marketed. It will be possible to make a substantial down payment and get a plane, paying out the balance on the same plan that is used in the automobile field. This will be accomplished through a national agency with which American Eagle is now negotiating, instead of through local agencies.

This company believes that the future of the person or firm entering the retail end of the aviation business is one of unlimited possibilities—every bit as bright as was the motor car merchandising field plus the advantage of the lessons learned in that field's pioneering. "Man is seeking speedier transportation, something to help him travel farther and faster in his brief span of life," they declare. "Merchandising aircraft is simply a matter of acquainting the public with its advantages.

"By making an intelligent canvass of his territory—selecting prospects who can and will consider the airplane as a utility and necessity, and not as a pleasure or excitement craft—any dealer with business acumen can merchandise aircraft. Today airplane selling is a business of creating market. Once this seed is sown by pointing out the utility and

AIRPLANES MOTORS SUPPLIES

New Travelair three place biplane equipped with $650 Pioneer instrument board with instruments; also 120 H.P. Anzani motor, new 1927 model not installed together with new metal propeller; total cost to purchaser $5000. Will sell for $4500. Dandy slightly used 150 H.P. model A Hispano $695. Slightly used 130 H.P. 9 cyl. Clerget rotary motor $150.

Winter flying suits, fur lined with wool interlining, fur collar $95.00, or dog hair lined with wool interlining $90.00. These are highest grade suits with hookless fasteners and sunset seats. Sheeplined flying suits $50.00; woolen hair lined $47.00; felt lined $35.00. All flying suits have hookless fasteners. Fur lined leather helmets $10.00; sheeplined leather helmet $5.50. Sheeplined moccasins, surplus $5.00 or new production $9.00. Sheeplined, specially good moccasins with leather soles, $12.75.

Non-shatterable goggles: NAK wide-vision $4.00 or jumbo oval $2.50. Lamoglas wide-vision No. 36, $4.00; No. 24 medium wide, $3.50. Face mask goggles, $4.50. Luxor No. 5, $7.50; No. 6, $9.75; No. 6 Luxor U. S. Air Service, $10.75; No. 7, U. S. Luxor Air Service, $13.75. Commander curved lens, very wide vision rubber protected goggle, $20.00. Seesall goggle, $15.00. Leather face mask only, $2.00.

Burd high compression pistons for OX5 15c each; $2.00 per set 16; $10.00 for 100 or $40.00 for 500. Burd high compression piston rings for OXX6 30c each or $4.00 per set 16; $20.00 per 100. Exhaust push rod yoke OX5 or OXX6 60c or $12.50 for 25. Long cylinder studs 30c each or $9.00 per set 32. Dandy new OX5 Zenith carburetors $50.00 or slightly used, excellent condition ones $40.00. Berling magnetos for OX5 $50.00. Lower wings for Curtiss JN4, unused, covered excellent condition $65.00 for rights, $75.00 for lefts; uppers $85.00 each. Canuck lower or upper covered unused wings $90.00.

Curtiss OX5 toothpick propellers $35.00. Flottorp, semi-toothpick $30.00. C. A. L. untipped propeller for OX5 $15.00. Hartzell OX5 propellers $80.00. Hartzell propeller for Warner motored Stinson, Jr. $80.00. Hamilton for Wright motored cabin job $126.

All parts for Canuck, JN4D, J-1 Standard, OX5, OXX6, and many Hispano, Lawrence, Fiat, Liberty and LeRhone parts.

Logan Airplane Motors Co.
716 W. Superior Cleveland, O.

need of the airplane, selling the ship is not difficult."

Every day, cities large and small are developing new facilities for the accommodation of air travel. Cities which are laggard in providing airports are already losing money; and when a city finds itself missing from the nation's air map, the condition is soon remedied. This of course benefits aviation, for first of all the crying need of the industry is for first class flying fields equipped for night as well as day flying.

"The airplane of tomorrow may be as different from the airplane of today as the first automobile was from the 1928 model. But tomorrow, it is a surety, we will have airplanes—a vast army of them. Seeking always speedier means of communication and travel, man today has nothing faster or surer than the airplane. For this reason alone the man or company entering airplane retailing today will find himself in highly profitable business tomorrow."

Further evidence of the opportunities in airplane retailing is offered by the Stearman Aircraft Company of Wichita, Kansas, whose present sales organization consists of 7 distributors and 14 dealers. One of these, George A. Wies, Inc., of Mineola, Long Island, has sold 26 Stearmans since the first of last March—during that period making $10,000 net out of the Stearman franchise.

Their contracts are considered very favorable to the retailer, in that all retail sales in his territory are passed to him. The manufacturers sell nothing but territory, leaving the direct sale of planes to the retailer and referring all inquiries from his territory directly to him. Moreover, in addition to furnishing all advertising material to their retailers at cost, the Stearman factory assumes the obligation to advertise its product aggressively in all the national trade papers, and at this time is negotiating for advertising space in publications other than the aviation trade journals.

The Stearman Company is positive that "the right line, which implies good design and good merchandising policies, holds the same possibilities for the dealer today that the Buick franchise (for example) held for the dealers who chose it ten or fifteen years ago. Commercial aviation is now out of the barnstorming period and is entering upon a substantial growth that calls for intelligent and careful direction to the point that

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Address.....

City..... *State*.....

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One of the largest, best equipped aviation schools in the U. S. offers limited number a quick thorough training in new class just forming.

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After you finish ground work we give you unlimited Flying Time in the air under the guidance of a skilled pilot until you can successfully "Take off," "Fly" and "Land" a plane alone.

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Government statistics show a big demand for trained men in Aviation. The demand is growing. Private Commercial lines are springing up in every section of the U. S. Numerous Aircraft Manufacturing Companies and Sales Agencies are in need of trained men.

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within ten years its degree of development will be unlimited."

The total number of retail outlets of The Swallow Airplane Company, whose factory is also located at Wichita, Kansas, is 75—of which 35 are distributors. That their retailers too are making money is indicated by the fact that their Los Angeles dealer recently sold four planes in a single week, while their Wisconsin representative at Manitowoc recently accepted six Swallows in one flyaway delivery—all of which were sold in two weeks.

In their opinion too, "the airplane industry will be a repetition of the automobile in amount of business and possibilities." They believe further that, figuring the aircraft industry of today where the automobile industry was when the same number of machines were being sold—say, 25 years ago—the airplane industry will see a greater production in its next five years than the automobile did in its corresponding period.

The Swallow Company "bases this opinion on the receptive frame of mind of the present generation to speed and new creations, and to the development of the automobile industry which the airplane industry can refer to as a precedent—in engineering as well as in production and distribution."

E. M. Laird of Chicago is hopeful for 1929. Laird planes were turned out at the rate of one every two weeks during 1928. It is expected that this production schedule will be tripled during 1929. Earl Daugherty of Long Beach, and Fred Becker of Port Washington, Long Island, are among the most successful Laird distributors. Like many other manufacturers, the Laird company believes that time payment methods of retailing planes will eventually become more common, though they feel that the distribu-

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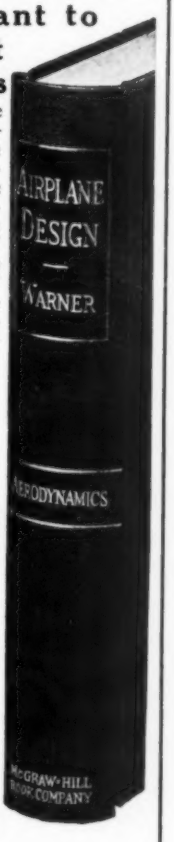
All you want to know about aerodynamics



THE first volume of a series of airplane design. The book presents a thorough, authoritative treatment of aerodynamics; a synthesis and interpretation of the prior art and the existing state of knowledge in the fundamental principles of airplane design.

Airplane Design

AERO-DYNAMICS

Edward P. Warner
Professor of Aeronautical Engineering, Massachusetts Institute of Technology; Appointed Assistant Secretary of the Navy for Aeronautics, July, 1926

600 pages, 6x9, 333 illustrations, $7.50

THE object of the book is to serve the requirements of airplane design, though the topics treated are not uniformly characterized by immediate availability of practical application. Matter of abstract or academic interest is introduced where, but only where, it will round out the picture of aerodynamic development, not as a group of disconnected results of disconnected tests, but in the aggregate. The discussion is detailed and complete, covering in logical sequence every phase from nomenclature to controls and controllability; maneuverability, and spinning.

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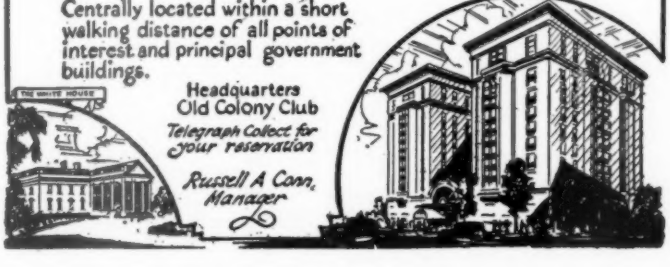

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tor, in connection with a finance company, will naturally be the initiating factor in this program.

Travel Air takes the position that dealers should be men of established credit, of demonstrated business ability, and of some experience in aviation. Automobile distributors, because of their knowledge both of the automotive field and of salesmanship generally, are considered valuable prospects for commercial aviation personnel. Among the dealers who are outstandingly successful in distributing Travel Air planes, are H. C. Lippiatt of Los Angeles; the Travel Air Ways of Dallas; Wm. H. Emery, Jr., of Bradford, Pa.; Bob Shank of Indianapolis; Flyers, Inc., of Albany; and the N. R. Airways, Inc., of Mineola, L. I., N. Y. There are 37 Travel Air distributors, with dealers located at more than a hundred different points.

Another Wichita manufacturer, Clyde V. Cessna, reports plans for an expanded program of distribution. Forty-six Cessna monoplanes have been built and delivered since the company was organized, and with increased production facilities, this number will be increased rapidly. The Beacon Airways of Kansas City in the middle west, and the Atlantic Sales Corporation in the east, are among the distributors of Cessna Aircraft who have done highly successful work.

Command-aire, Inc., of Little Rock, Ark., will be in quantity production immediately. At the Chicago show more than two hundred orders were signed, two different contracts for 50 planes each being entered into with Herbert R. Miller of Los Angeles and Aviation Service & Transport Co., Inc., of Chicago, besides one for 60 planes with W. B. Hunt Bancroft Smith, of New York. Ten planes were purchased by A. R. Taylor of Detroit, and twenty by the Eastern States Aircraft Co., of Springfield, Mass. Twenty-four went to the General Aviation Corporation of Syracuse, and another lot of 25 was contracted for by the Congressional Airport Co., of Washington, D. C.

Major J. Carroll Cone, director of sales for Command-aire, expressed great satisfaction over the outlook for 1929. Production is to be very considerably increased during the year, and this expansion would have had to take place on the basis of the orders already in hand before the Chicago exhibit even without the stimulation which was received there. Time payment can be arranged with dealers on the Pacific Coast, according to Major Cone, and although the Command-aire company does not itself engage in such arrangements, it does not discourage this practice among its distributors.

Despite the fact that there are already 29,505,475 motor vehicles in operation, the coming year will probably be the greatest in the production of automobiles the world has ever known. But even while we are realizing that American automotive dealers and distributors now earn $800,000,000 a year in commissions, the purring motor of an airplane overhead is voicing a thrilling invitation of immeasurable opportunity. The public needs and wants aviation. Aviation needs and wants retailers. Why not get in on the ground floor of this promising industry, and retail airplanes in your territory?

Curtiss Flying Service

(*Continued from page* 68)

dusting, aerial photography and surveying, taxi service, and cross-country flying will be undertaken by each of the units, as demand is made for this type of work.

Mr. Keys' statement read, in part, as follows:

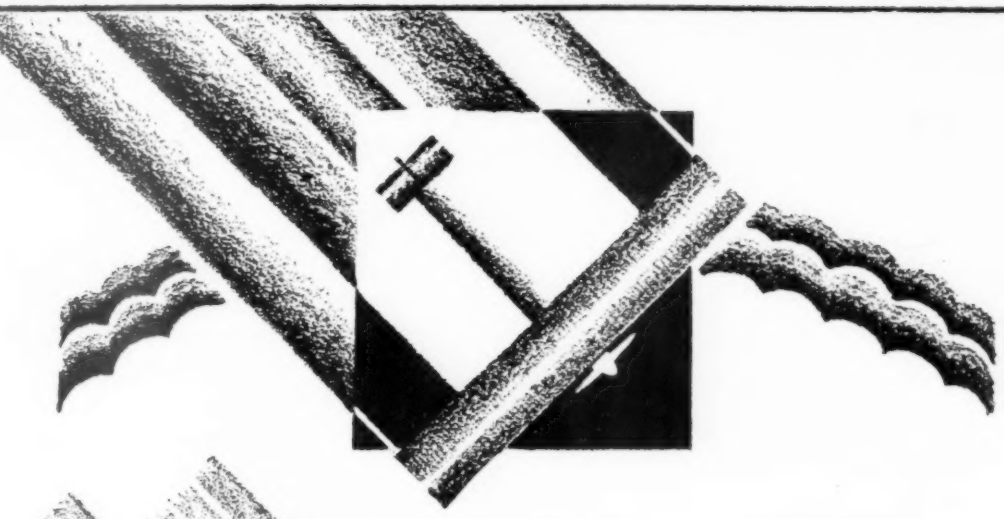
"Your company started business on September 17, 1928, with $6,750,000 in hand, together with the ownership of all the capital stock of the Curtiss Flying Service of New York, a company which had been operating at Curtiss Field, Mineola, for many years.

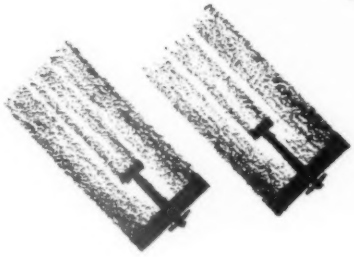
"Your company is now operating Curtiss Field at Mineola, and fields at Portland, Maine; Bridgeport, Connecticut; Miami, Florida; and Palm Beach, Florida, the two latter being land and water operations. There is no training school at Palm Beach, but a school has been established at Miami.

"Fields at the following points are scheduled to begin operations in the early spring of 1929: Boston, Syracuse, Buffalo, Cleveland, Detroit, Chicago, Toledo, Columbus, Indianapolis, Louisville, and St. Louis.

"Negotiations are under way at the following cities looking to the establishment of operations in the late spring or early summer of 1929: Kansas City, Philadelphia, Washington, Minneapolis, Denver, Los Angeles, and San Francisco.

"Your company has also under consideration fields at Tulsa, Okla.; Wilmington, Del.; Portland, Ore.; Spokane, Wash.; Pittsburgh, Pa.; and Grand Rapids, Mich."





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Popular Aviation is now
AERONAUTICS

Radio Requirements

(*Continued from page 29*)

diate-frequency equipment and that it will be necessary to change to high-frequency apparatus to make further advances along this line. High-frequency observation equipment has been under development for the past year and a half at the laboratory located in Washington, D. C.

This laboratory has made important studies in the design, development, and test of new aircraft radio equipment, and has co-operated to the fullest extent with the Bureau of Aeronautics at all times." The problems now in hand are:

(a) Design of a light-weight radio telephone set for combat planes; (b) Design of a high-frequency radio set for observation planes; (c) Design of a high-frequency radio set for scouting planes; (d) Design of an intermediate-frequency radio set for scouting planes; (e) Development of a fixed radio compass for scouting planes; (f) Development of a retractable radio compass for lighter-than-air craft; (g) Development of intermediate and high-frequency equipment for rigid airships; (h) Development of gasoline-engine-driven emergency power apparatus.

The redoubled efforts of the Navy Department in coping with aircraft radio problems are prompted by two major reasons—to meet an exigency for equipment of this kind and to temper a storm of public criticism. The question "What is the matter with naval aircraft radio?" has appeared with such frequency and insistency during the past year as to remind us of that famous interrogation, "What is the matter with Kansas?"

This question, as applied to the Navy, was first propounded in a radio editorial, about two years ago, by Professor J. H. Morecroft of Columbia University, and one of America's outstanding radio authorities. At that time the question was asked in connection with the attempted Hawaiian flight of Commander John Rogers, which attempt came to grief. The answer of the Navy, briefly, was that emergency radio equipment had to be sacrificed in deference to the requirement of a minimum seaplane load. Hence, we find Admiral Moffett prescribing "maximum power per pound of weight" for future aircraft radio apparatus.

Did You See the
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The query of Professor Morecroft, "What Is the Matter With Naval Radio," though asked more than two years ago, has been repeatedly heard as an echo during the past year. Other flights of the Navy in which either radio was lacking or inadequate have served to amplify that echo until it can be heard with the distinctness of the original voice. However, the recent efforts of the Navy to cope with these problems, regardless of time or cost, are likely to bear fruit. In fact, Admiral Moffett declares, "It is believed that these problems can be solved and experimental sets constructed before the close of the fiscal year 1928," although no especial benefit will accrue to the Army through the engine muffling experiments, they will continue.

"The Army Air Corps never gives up on experiments of this nature," he said. "It may be that eventually we will find a way to eliminate the propeller noise, and then we will have attained the objective of these tests, and one that should result in a real benefit to military aviation."

Airplane Design

(*Continued from page* 48)

while cruising will be able to adjust the prop to a deeper pitch more conducive to fast flying at reduced throttle. The pitch may also be adjusted to various altitudes.

A multi-motored flying wing will be the trans-ocean transport plane of the future. It will be the ultimate word in speed and safety. Few steady travelers will willingly gamble their safety on a single motor over oceans or desert, no matter how dependable that one motor may become. Motors will be mounted in the wing in such a manner that mechanics may make temporary repairs while in flight.

Some people think nothing possible until proved. But as one participating in the steady advance of aeronautics, I feel safe in predicting that business and professional men, ranchers and salesmen within the next five years will be flying in just the type of aircraft I have pictured in this article.

Reactions of visitors to the exhibits at the International Aeronautical Exposition indicate that manufacturers who keep in touch with the taste of the public in matters of design and build accordingly, are going to meet with less sales resistance.

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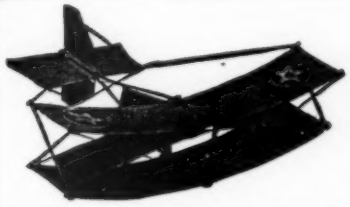

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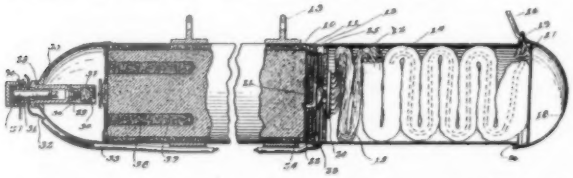
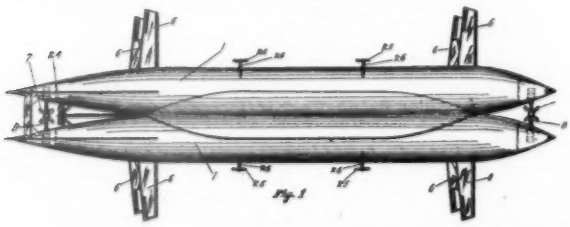
Patent Department

No. 1,686,117, PARACHUTE FLARE, Patented October 2, 1928, by Guy M. Ball, of Dayton, Ohio.



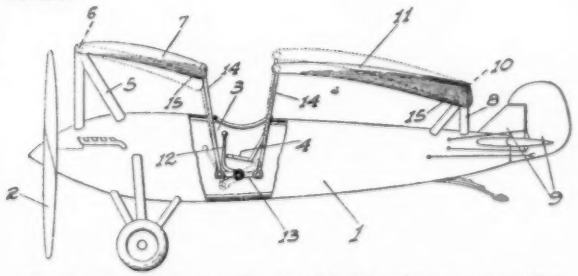
This invention relates to flares and more particularly to parachute flares adapted for use in night flying for lighting up the ground when landing, or for lighting up the ground in a similar way to facilitate bombing by aircraft.

No. 1,686,130, AIRCRAFT, Patented October 2, 1928, by Charles S. Hall, of Los Angeles, California.



A combination of lighter than air and heavier than air aircraft, providing means whereby the rigidity of the gas containers may be increased by arranging cylindrical gas containers with conical ends in parallel position with respect to the normal line of flight. Special driving means is provided of the dual type, the propellers operatively mounted in such a way that they can be swung at any described angle paralleling the sides of the aircraft.

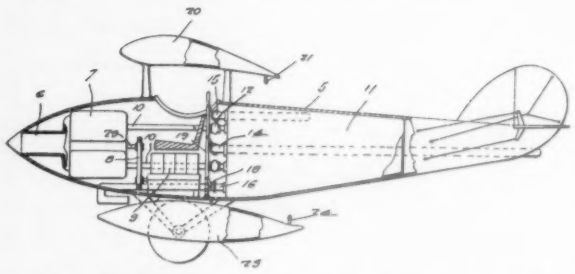
No. 1,685,888, AEROPLANE, Patented October 2, 1928, by George C. St. Louis, of Fresno, California, Assignor of One-Half to Francis A. Spooner, of Willows, California.



Dual wing surfaces are provided in this construction, one forwardly and one rearwardly of the pilot seat.

The wings are so mounted as to be movable relative to the fuselage in such a manner that the angle of ascent and descent of the plane can be controlled.

No. 1,686,071, AEROPLANE, Patented October 2, 1928, by Vincent Cavaleri, of Brooklyn, New York.



The invention disclosed in this patent resides in the provision of a propulsion unit which sucks in air from the front of the aeroplane, compresses it, stores it, and exhausts it rearwardly of the aeroplane as needed for propulsion purposes.

Special Features

This month's POPULAR AVIATION contains several features of more than ordinary interest. Look for

Prize Contest on page 84, the Aviation Clearing House on page 98, and the Aeronautics Travel Bureau on page 99.

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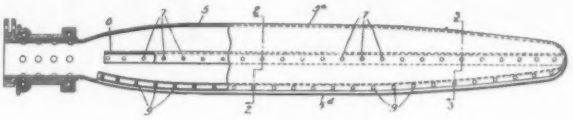
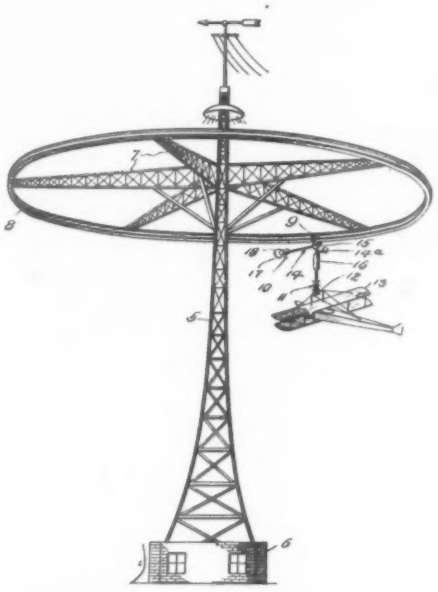
No. 1,685,881, PROPELLER BLADE, Patented October 2, 1928, by Moses C. Nixon, of Chicago, Illinois.



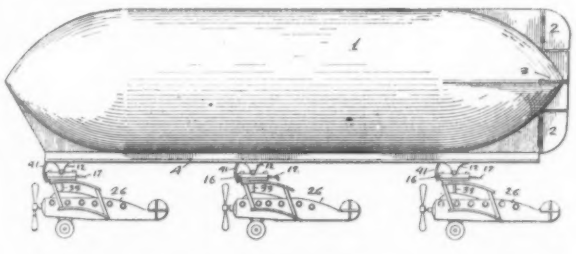
A hollow propeller blade of simple, strong and durable construction, reinforced so as to retain its true form and pitch under varying conditions.

No. 1,686,298, AIR OR SEAPLANE STATION, Patented October 2, 1928, by George A. Uhl, of San Antonio, Texas, Assignor of One-Third to George E. Ginter and One-Third to Phelps & Dewees, a Firm Composed of Raymond Phelps and George Dahl Dewees, all of San Antonio, Texas.



In this aerial station one form of grapple is used when a plane is to be started on a flight and the plane is supported by the grapple and the carriage proper and is driven under its own power beneath the annular track until sufficient speed has been attained to allow the plane to safely take the air. Still another form of grapple is used for the termination of a flight.

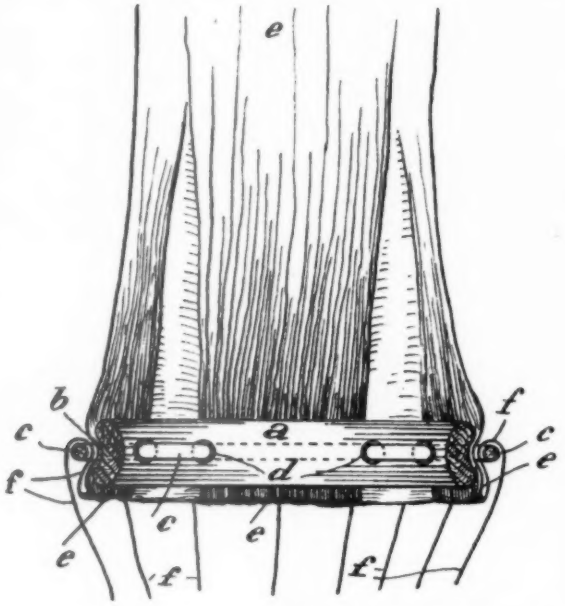
No. 1,687,000, AIRSHIP, Patented October 9, 1928, by Joaquin Silveira Abreau, of San Francisco, California.



An airship of the dirigible type, propelled and controlled by a plurality of detachable airplanes or propelling units, each of which is adapted to operate in conjunction with the other airplanes or units in pro-

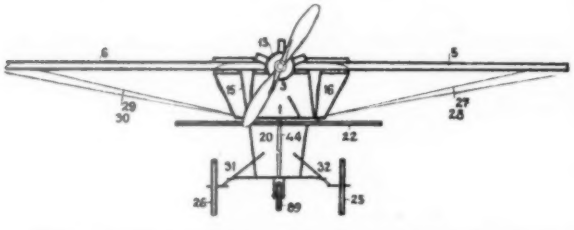
pelling and controlling the airship, and also adapted to operate as an airplane independently of the airship. The invention is in fact an aerial base for airplanes.

No. 1,687,064, DEVICE FOR FACILITATING THE SPREADING OF PARACHUTES, Patented October 9, 1928, by Giuseppe Furmanik, of Rome, Italy, Assignor to Giacomo Achille Calabi, of Rome, Italy.



This device comprises a ring of material, with radial perforations, in which an elastic cable is placed which is fitted into a groove of the outer circumference of the ring. Between the elastic cable and the outer groove or channel the end of the parachute fabric and its suspension ropes are inserted, so that at the moment of leap the air in penetrating into the inner circumference of the ring in addition to the pressure produced by weight will disengage the end of the fabric normally clamped between the elastic cable and the outer channel of the ring so as to spread the parachute.

No. 1,687,198, AEROHELICOPTER, Patented October 9, 1928, by Frantisek Formanek, Ladislav Zeman, and Edmund Zeman, of Bratislava, Czechoslovakia.



This invention relates to heavier than air flying machines, and has for its object to provide an improved aircraft in which shall be combined both the properties of an aeroplane and also those of a helicopter in that it shall be capable not only of horizontal flight and of volplaning in the manner of an ordinary aeroplane, but also of vertical ascent and descent and of hovering in any desired position in the manner of a helicopter.

No. 1,687,203, AIRCRAFT, Patented October 9, 1928, by Charles S. Hall, of Los Angeles, California.

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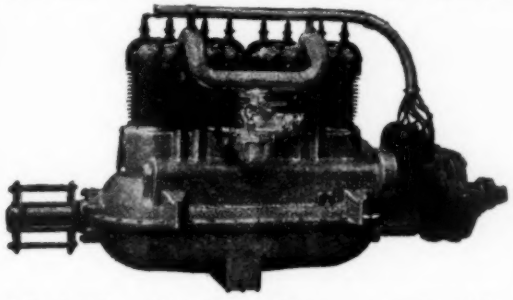

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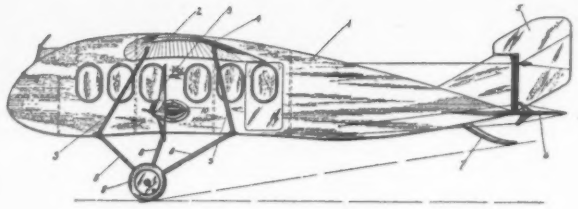
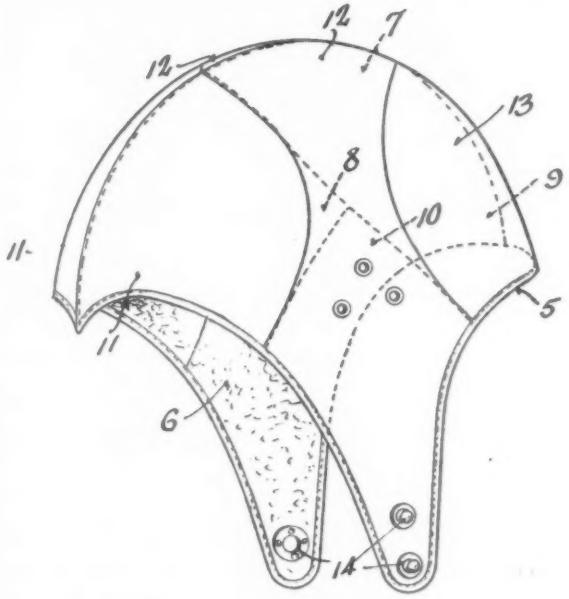


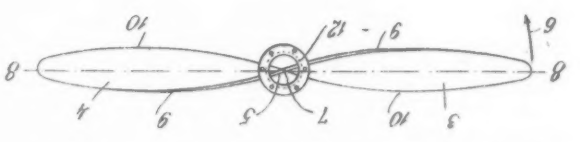
The propellers in this aircraft are mounted upon revolvable frames arranged upon the sides of the ship, thus permitting the propellers an unobstructed opportunity of producing an air stream paralleling the longitudinal line of flight. The propeller mountings also are so arranged that a thrust may be delivered at any angle upon a plane paralleling the line of flight.

No. 1,687,346, AVIATION CAP, Patented October 9, 1928, by Adolph Martin Mondl, of Oshkosh, Wisconsin.



A special pattern for aviation caps, in which the completed cap has the visible lines of seams evenly positioned, one running from the center of the forehead to the rear of the cap and the other seams being arc shaped and equally dividing the side portions of the cap.

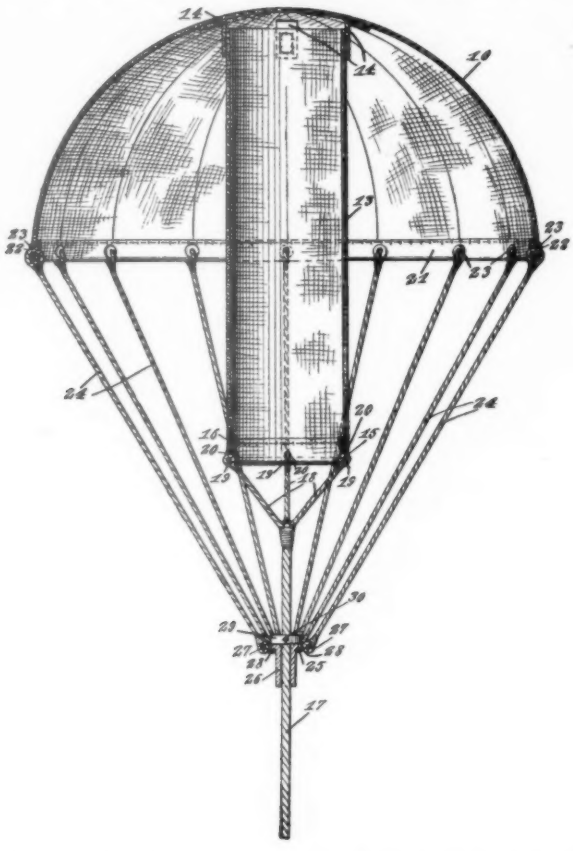
No. 1,687,636, AERONAUTICAL PROPELLER, Patented October 16, 1928, by Sylvanus A. Reed, of New York, New York, Assignor to The Reed Propeller Company, Inc., of New York, New York, a Corporation of New York.



An improvement on U. S. Patent No. 1,463,556, dated July 31, 1923, and having particular reference to metal airplane propellers. In this particular case the invention includes a simplification of structure whereby omitting the features needed for interchangeability with customary wooden propellers on the same steel hubs, a

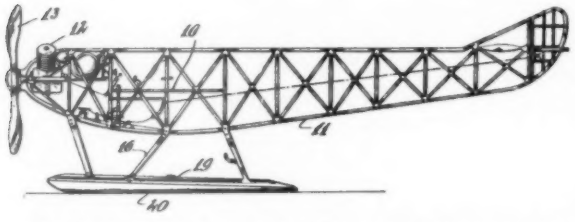
propeller may be obtained of greater efficiency and strength with less aggregate weight.

No. 1,687,884, PARACHUTE, Patented October 16, 1928, by Frank R. Owens, of Beaver Crossing, Nebraska.



A parachute having a dome of flexible material, a tube secured therein by one end, said end being in spaced relation to the dome of the parachute, a rigid ring secured in the lower end of the tube, a rope secured to said ring, ropes secured to the lower edge of the dome of the parachute and having a slidable connection with the first mentioned rope.

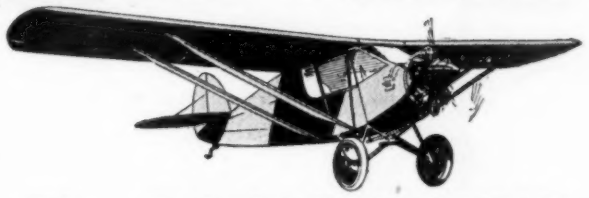
No. 1,689,807, HYDROPLANE, Patented October 30, 1928, by Carl H. Traver, of Binghamton, New York.



This invention relates primarily to an adjustable runner arrangement which will permit the airplane to land on water, snow, ice or the like. These supplementary runners are mounted within the pontoon of the hydroplane.

No. 1,687,955, GYROSCOPIC COMPASS, Patented October 16, 1928, by Harry L. Tanner, of Brooklyn, New

Here's a plane that sells itself



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Of POPULAR AVIATION published monthly at Chicago, Illinois, for October, 1928.

State of Illinois } ss.
County of Cook }

Before me, a Notary Public in and for the State and county aforesaid, personally appeared Harley W. Mitchell, who having been duly sworn according to law, deposes and says that he is the Editor of the POPULAR AVIATION and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 411, Postal Laws and Regulations, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are:

Publisher, Popular Aviation Pub. Co., Chicago. Ill.
Editor, Harley W. Mitchell, Chicago, Ill.
Managing Editor, None.
Business Manager, W. B. Ziff.

2. That the owner is: (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding one per cent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a firm, company, or other unincorporated concern, its name and address, as well as those of each individual member, must be given.)

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3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: (If there are none, so state.)

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4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom the trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

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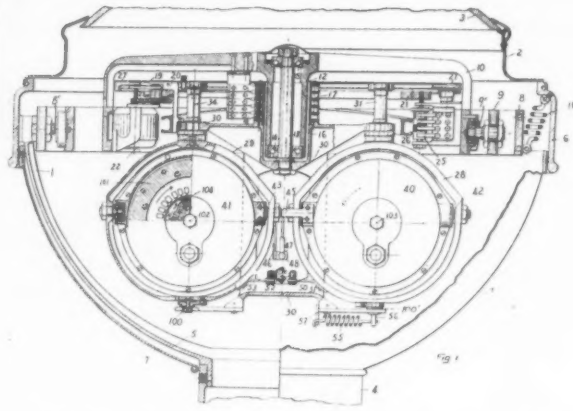
Sworn to and subscribed before me this 21st day of September, 1928.

(Seal) ARTHUR T. PULLEN.

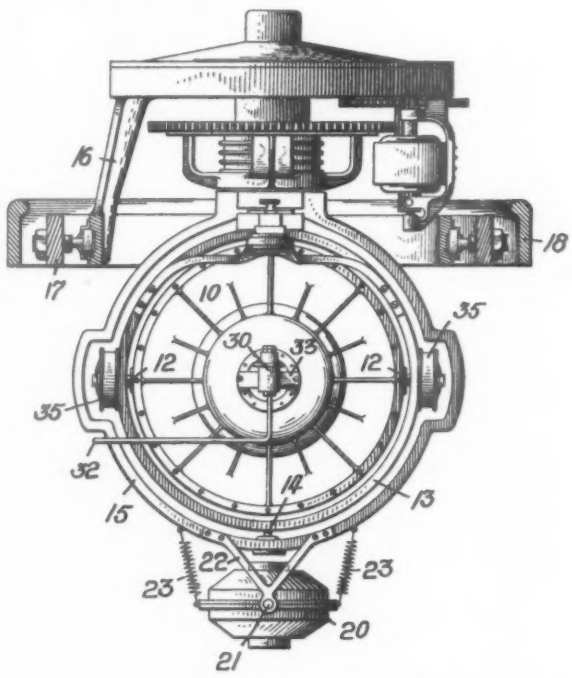
(My commission expires January 25, 1932.)

York, Assignor to The Sperry Gyroscope Company, of Brooklyn, New York, a Corporation of New York.



This invention relates to gyroscopic direction indicating instruments and more especially to the type of such apparatus which has a positive directive power, that is, an instrument which will seek the meridian, if displaced therefrom. The patent specifically improves upon prior patent No. 1,309,591, dated July 8, 1919.

No. 1,687,970, LIQUID CONTROLLED GYROSCOPIC COMPASS, Patented October 16, 1928, by Louis F. Corliss, of South Tamworth, New Hampshire, Assignor to The Sperry Gyroscope Company, of Brooklyn, New York, a Corporation of New York.



This patentee claims a gyroscopic compass mounted with three degrees of freedom, means responsive to deviation of the gyro axis from the meridian, means for applying a torque to said gyroscope, and means including an oscillatory electric circuit whereby said first means controls said second means.

Index to Advertisers

Ace Aeroplane & Model Supply 92
Acme Airways 122
Advance Aircraft Co..... 41
Aero Engineering Service Co., Inc..... 77
Aero Kite Co.....123
Aero Model Co.....131
Aeronautica 123
Allan, A. Livingston.....123
Alexander Aircraft Co. 75, 132
American Eagle Aircraft Corporation 39
American Model Aircraft Co. 94
American School of Aviation 8
American Society for Promotion of Aviation 79, 113
Ancient Art Metal Co.....114
Atkinson Aviation Co.....123
Aviation Engineering School 122
Aviation Finance & Trading 104
Aviation Institute of U. S. A. 81
Aviation Service and Transport, Inc. 83
Aviator Goggle Co.....111
Barrett Airways, Inc.....106
Beck Distributing Corp...123
Becker's 121
Bennett Flying School....122
Braley Flying School..... 85
Brownback Motor Laboratories 128
Cessna Aircraft Co..... 43
Chicago Salvage Stock Store 120
Clinton Toy Corp..... 95
Commercial Aviation Co., Inc. 116
Command-aire 51
Commercial Aircraft Sales 106
Consolidated Instrument Co. 10
Coyne Electrical School..130
Detroit Show.....119
Durante & Co., A. A.....106
Eagle Airport School.....122
Fairchild School of Aeronautics 122
Fairchild Aviation Corporation 3
Fleischmann Trans. Co...118
Flug-Woche 122
Greer College..... 47
Guardian Aircraft Co..... 71
Heath Airplane Co.....120
Norman W. Henley Pub. Co. 69, 105
Hoit Rose & Troster.....107
Hotel Belvedere 125
Hotel Piccadilly 121
Hotel Hamilton 117
Hotel Lexington 110
Hotel Roosevelt 110
Hotel Paul Revere.....110
Hotel Benjamin Franklin 126
Ideal Aeroplane & Supply Co. 89
Irwin Aircraft Co.....121
Johnson Co. 117
Kansas City Chamber of Commerce 59
Lancaster & Allwine 121, 122
Lincoln Airplane School..126
Logan Airplane Motors..115
Lycoming Mfg. Co..... 57
McMullen Aviation School 122
McGraw Hill Book Co. 117, 129
Mann & Benton 92
Magosy & Buscher.....122
Marr, T. 127
Marshall Flying School.. 67
E. B. Meyrowitz.....121
Michigan State Aviation School 112
Michigan Model Airplane Supply 92
Mid West Airways Corp. 122
Mt. Carmel Mfg. Co..... 93
New York Show..... 45
National Aviation Training 121
National Aero Corp.....125
Naturaline Company of America 2
O'Brien, Clarence A.....120
Ogden Park Flying Club 122
Ohio Aero School.....116
Pacific · Technical University 115
Parks Air College 60, 61
Peru Model Airplane Shop 92, 94
Polachek, Z. H.....121
Porterfield Flying School 65
Posey & Co., J. V. G.....122
Pouch, K. A..... 92
Prosser, J. Roy.....107
Rankin System, Inc..... 49
Robertson Flying Services, Inc. 109
Robinson & Co., H. S.....107
Roth-Downs Airways, Inc. 5
Ryan School, T. C.....122
Searight & Co.....106
Seaton, C. F.....120
Simplex Air Model Co..... 95
South American Service Bureau 111
Star Aircraft Co.....127
Stinson School 63
Swallow Airplane Co..... 53
Taylor, D. D.....122
Taylor Brothers Aircraft Corp. 120
Travel Air Manufacturing Co. 55
Universal Airlines 4
U. S. Model Aircraft Corporation 94
H. R. Van Deventer..... 75
Von Hoffman Aircraft Co. 117
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